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OF

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OR,

COMPLETE Practical Arithmetic.

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MASTER OF THE FREE SCHOOL, LEATHLEY.

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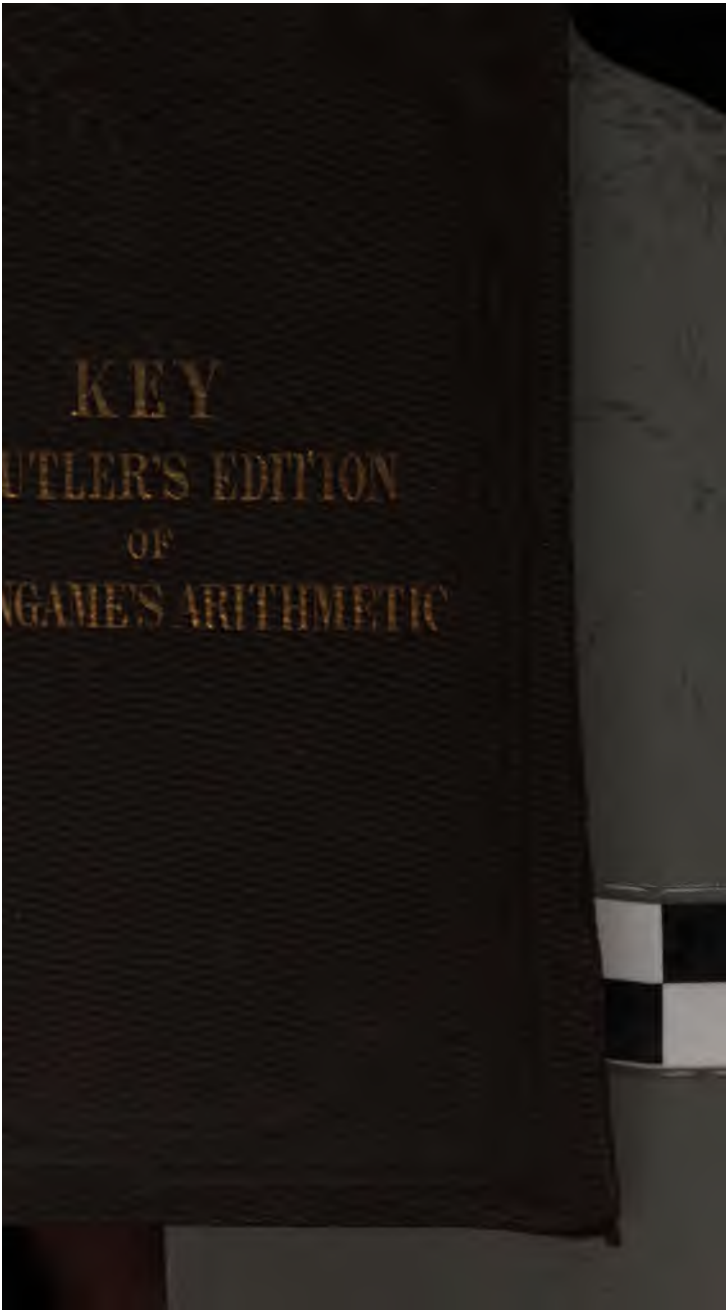

KEY
UTLER'S EDITION
OF
NGAME'S ARITHMETIC

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EXPLANATION OF THE CHARACTERS USED IN ARITHMETIC, ETC.

$+$ denotes *plus* or *more*. The sign of *addition*, signifying that the numbers between which it is placed are to be added together. Thus $9 + 6$ denotes that 6 is to be added to 9. In geometrical lines, also, AB + CD signifies that the line AB is to be increased to the line CD. Also $a + b$ denotes the sum of the quantities represented by a and b.

$-$ denotes *minus* or *less*. The sign of *subtraction*, signifying that the latter of the two numbers between which it is placed is to be taken from the former. Thus $5 - 3$ denotes that the 3 is to be taken from the 5. In geometrical lines, also, AB — CD signifies that the line CD is to be taken from the line AB. Otherwise $a - b$ denotes their difference when b is the less, and $b - a$ shows their difference when a is the less.

$\backsim$ denotes *difference;* and is written between two numbers or quantities to denote their difference, when it does not appear which of them is the greater; as $\frac{13}{17} \backsim \frac{19}{130}$, or $a \backsim b$.

$\times$ or . denotes *into*, or *by*. The sign of *multiplication*, signifying that the numbers between which it is placed are to be multiplied together. Thus 8×6 denotes that 8 is to be multiplied by 6. In geometrical lines, also, AB × CD, or is expressed thus, AB . CD, and signifies that the line AB is to be multiplied by the line CD, or the rectangle formed by the lines AB and CD. Again, $a \times b$ expresses the product of the quantity a by the quantity b, and $a \cdot b$ or ab signifies the same thing. Again 5 AB or $5a$ denotes that the quantity AB or a is to be taken 5 times; and $7(a+b)$ is 7 times $a+b$; and these numbers 5 or 7, showing how often the quantities are to be taken or multiplied, are called the coefficients. The sign of multiplication between the coefficient and parenthesis is very often left out, it being always understood that the quantities which are included by the parentheses, are to be multiplied by the coefficient.

$\div$ denotes *divided by*. The sign of *division*, signifying that the former of the two numbers between which it is placed is to be divided by the latter. Thus, $8 \div 4$ denotes that 8 is to be divided by 4. This is also expressed by placing the dividend above a line, and the divisor below it. Thus, $\frac{8\ \textit{numerator}}{4\ \textit{denominator}}$ denotes that 8 is to be divided by 4. In geometrical lines, also, $AB \div CD$ signifies that the line AB is to be divided by the line CD; or thus, $\frac{AB}{CD}$. Otherwise $a \div b$, or $\frac{a}{b}$ shows that the number represented by a is to be divided by that which is represented by b. Also $\frac{a}{b}$ is the reciprocal of $\frac{b}{a}$; and $\frac{1}{a}$ is the reciprocal of a; for the reciprocal of any quantity is that quantity inverted, or unity divided by it.

: is to
:: as
: is to

denote *proportionals*, signifying that the numbers between which they are placed are *proportional*. Thus, $2:4::8:16$, denotes that the number 2 bears the same proportion to 4 as 8 does to 16, and is usually read 2 is to 4 as 8 is to 16.

Proportion in arithmetic is the equality or similitude of ratios, as the four numbers 2, 4, 8, 16, are proportionals, or in proportion, that is, if $\frac{2}{4} = \frac{8}{16}$, the ratio of 2 to 4 is equal or similar to the ratio of 8 to 16, both of them being the same as the ratio of 1 to 2.

Proportion is often confounded with ratio, but they are quite different things, for ratio is properly the relation of two magnitudes or quantities of one and the same kind, as the ratio of 2 to 4, or of 8 to 16, or of 1 to 2, so that ratio exists between two terms; but proportion between two ratios and four terms.

$=$ denotes *equal to;* the sign of equality, signifying that the numbers between which it is placed are equal to each other. Thus, 2 poles+2 poles=4 poles=22 yards=1 chain =100 links.

$\overline{}$ denotes a *vinculum;* and ( ) denotes *parentheses ;* [ ] denotes *crotchets ;* and { } denotes *braces.* These signs are made use of to connect two or more quantities together, and they are synonymous with regard to their application; for,

$$(\overline{7+4}-5)\times 8=[7+4)-5]\times 8=(11-5)\times 8=6\times 8=48,$$

is the same as

$$[(7+4)-5]\times 8=(11-5)\times 8=6\times 8=48,$$

or

$$\{(7+4)-5\}\times 8=(11-5)\times 8=6\times 8=48.$$

The *vinculum*, or *parentheses*, which includes the 7 and 4, serves as a chain to link them together, or to connect two or more quantities into one, and shows that they are to be added together before the number 5 is subtracted; and the *crotchets*, and also the *braces*, show that the numerals which they include must be operated upon, and the result multiplied by the number 8.

$^{2}\ ^{3}\ ^{n}$ denotes *indices*, or *exponents*. These expressions, placed above a quanity to the right, show to what power it is understood to be raised; as 10^2, 10^3, a^n, &c., which represent the square and cube of 10; and also the *n*th power of *a;* thus, $10^2=10\times 10=100$, and $10^3=10\times 10\times 10=1000$; also a^n, meaning that a is the factor as often as there are units in n, whatever number n may be.

$\sqrt{\ }\ \sqrt[3]{\ }\ \sqrt[n]{\ }$ denote *radical signs*. Any one of these expressions, placed before a quantity, represents that the quantity is to have its respective root extracted; it is also expressed by a fractional index, or exponent, placed over, and a little to the right of, the given quantity.

Thus, the square root of 36 is expressed by $\sqrt{36}$, or $(36)^{\frac{1}{2}}$; the cube root of 64 by $\sqrt[3]{64}$, or $(65)^{\frac{1}{3}}$; and the *n*th root of a by $\sqrt[n]{a}$, or $a^{\frac{1}{n}}$, &c.

$^{\circ}\ '\ ''\ '''\ ''''$ denotes *degrees, minutes, seconds, thirds,* and *fourths*, when placed above a quantity to the right; thus, 70 *degrees*, 16 *minutes*, 34 *seconds*, 49 *thirds*, 57 *fourths*, are expressed by 70°, $16'$, $34''$, $49'''$, $57''''$. Also, one of these characters is made use of sometimes to denote a *repeating decimal*, when placed above the quantity to the right; thus, the *repeater* ·819444 &c. is expressed by $\cdot 8194'$; and the same dash denotes a *circulate*, when placed over its first and last figure to the right; thus, ·769230769230, &c. is expressed by $\cdot 7'6923 0'$. A dot placed over the figure in circulating decimals, is frequently made use of instead of the dash. Again, some of these characters are made use of for lineal measure; thus, 10 *inches*, 8 *seconds*, 7 *thirds*, 5 *fourths*, are expressed by $10'$, $8''$, $7'''$, $5''''$,

$\therefore$ denotes *therefore.*

$\because$ denotes *because.*

$\angle$ denotes an *angle;* as, $\angle$ A signifies the angle A.

$\perp$ denotes *perpendicular to.*

$>$ denotes *greater than,* as $A > B$, shows that A is greater than B.

$<$ denotes *less than,* as $A < B$, shows that A is less than B

KEY.

PART I.

NUMERATION AND NOTATION.

Notation.

Words expressed in Figures.

Answers.

(1.) 23.	(4.) 25856.	(7.) 27157832.
(2.) 254.	(5.) 132245.	(8.) 722231504.
(3.) 3204.	(6.) 4941400.	(9.) 602210500.

Numbers expressed in Words.

Answers.

(10.) Thirty-five.
(11.) Fifty-nine.
(12.) One hundred and seventy-two.
(13.) Two thousand and sixteen.
(14.) Five thousand, two hundred and one.
(15.) Twenty thousand, seven hundred and sixty.
(16.) Five hundred, nineteen thousand and seven.
(17.) Seven hundred, fifty thousand and fifty-eight.
(18.) Five millions, nine hundred thousand and thirty.
(19.) Five millions, two hundred four thousand and fifty-four.
(20.) Two millions, seventy-one thousand nine hundred and nine.
(21.) Seventy millions, fifty-four thousand and eight.
(22.) Sixty-five millions, seven hundred thousand and forty-seven.
(23.) Ninety millions, six thousand one hundred and fifty-seven.
(24.) Two hundred one million, nine hundred thousand seven hundred and ninety.

ADDITION OF INTEGERS.

Answers.

(3.) 3054. (4.) 33566. (5.) 37525. (6.) 344978.

SUBTRACTION OF INTEGERS.

Answers.

(2.) 2029. (3.) 7991. (4.) 105089. (5.) 118767.

MULTIPLICATION OF INTEGERS.

CASE I.

(2.)
52471021
3
Ans. 157413063

(3.)
7925437521
4
Ans. 31701750084

(4.)
27104107
5
Ans. 135520535

(5.)
231037
6
Ans. 1386222

(6.)
7062526
7
Ans. 49437682

(7.)
3723104
8
Ans. 29784832

(8.)
4214406
9
Ans. 37929654

(9.)
2701047
10
Ans. 27010470

(10.)
31040171
11
Ans. 341441881

(11.)
35210472
12
Ans. 422525664

CASE II.....(12.)
4710572
13
Ans. 61237436

(13.)
5107252
14
Ans. 71501528

(14.)
6653210
15
Ans. 99798150

(15.)
92057165
16
Ans. 1472914640

(16.)
6251721
17
Ans. 106279257

(17)
9215324
18
Ans. 165875832

(18.)
2571341
19
Ans. 48855479

(19.)
3592104
19
Ans. 68249976

Case III.

(21.)
32104
25
160520
64208
Ans. 802600

(22.)
2710432
375
13552160
18973024
8131296
Ans. 1016412000

(23.)
27501976
271
27501976
192513832
55003952
Ans. 7453035496

(24.)
571204
27009
5140836
3998428
1142408
15427648836

(25.)
7104325
57020
142086500
49730275
35521625
405088611500

(26.)
5271094
590030
158132820
47439846
26355470
3110103592820

When some portion of the multiplier forms a *composite* number, and some other portion of it is a *factor* of the same, the work may generally be much abridged. When you have multiplied by such *factor*, multiply its product by the *other factor* of the *composite,* which will produce at once the product of the multiplicand by the composite number.

Example.

Multiply 60713 by 96488

60713
96488
485704 product by 8.
2914224 product of 8×6=48.
5828448 product of 8×12=96.
5858075944

CASE V.

(27)	(28.)	(29.)	(30.)
27100	379500	265000	574000
52600	274000	7200	630
1626	15180	530	1722
542	26565	1855	3444
1355	7590	1908000000	361620000
1425460000	103983000000		

CASE VI.

(31.)	(32.)	(33.)
771039	921563	715241
7×5=35	4×8=32	7×8=56
5397273	3686252	5006687
5	8	8
26986365	29490016	40053496

NOTE. The product of two numbers can have, at *most,* only the *same number* of figures as there are in *both factors,* and *at least* but *one less.*

DIVISION OF INTEGERS.

CASE I.

(2.) $240490\frac{2}{3}$=*Ans.*
(3.) 1802604=*Ans.*
(4.) $1440657\frac{2}{5}$=*Ans*
(5.) $871839\frac{3}{6}$=*Ans.*
(6.) $33385\frac{6}{7}$=*Ans.*
(7.) $318415\frac{5}{8}$=*Ans.*
(8.) $2783145\frac{1}{9}$=*Ans.*
(9.) $275001\frac{2}{10}$=*Ans.*
(10.) $246410\frac{3}{11}$=*Ans.*
(11.) $2258394\frac{4}{12}$=*Ans.*

CASE II.

(13.) 37)7210473($194877\frac{24}{37}$=*A.*
37
351
333
180
148
324
296
287
259
283
259
24 *Remainder.*

(14.) 473)2104721($4449\frac{344}{473}$=*A.*
1892
2127
1892
2352
1892
4601
4257
344

(15.) 275)3720147($13527\frac{222}{275}$=*A.*
275
970
825
1451
1375
764
550
2147
1925
222

(16.)
3701)72109521($19483\frac{2928}{3701}$=*A.*
3701
35099
33309
17905
14804
31012
29608
14041
11103
2938

(17.) 3576)72104725($20163\frac{1837}{3576}$-*A*
7152
5847
3576
22712
21456
12565
10728
1837

(18.) 2510)63210476(25183$\frac{1146}{2510}$=*A.*
5020
13010
12550
4604
2510
20947
20080
8676
7530
1146

(19.) 25204)321047217(12737$\frac{23869}{25204}$-*A.*
25204
69007
50408
185992
176428
95641
75612
200297
176428
23869

(20.) 31709)521047321(16432$\frac{5033}{31709}$-*A.*
31709
203957
190254
137033
126836
101972
95127
68451
63418
5033

(21.) 2701234)7210472532(2669$\frac{878986}{2701234}$=*A.*
5402468
18080045
16207404
18726413
16207404
25190092
24311106
878986

(22.) 210472)352107193214(1672940$\frac{165534}{210472}$=*Ans.*
210472
1416351
1262832
1535199
1473304
618953
420944
1980092
1894248
858441
841888
165534

(23.)

3721071)21071921473(5662$\frac{3217471}{3721071}$=*Ans.*
18605355
24665664
22326426
23392387
22326426
10659613
7442142
3217471

CASE III.

(24.)

271,00)254732,21(939$\frac{26321}{27100}$=*A.*
2439
1083
813
2702
2439
26321

(25.)

5721,00)7253472,16(1267$\frac{496516}{572100}$=*Ans.*
5721
15324
11442
38827
34326
45012
40047
496516

(26.)

373,000)752473,719(2017$\frac{132719}{373000}$=*A.*
746
647
373
2743
2611
132719

(27.)

215,000)6325104,997(29419$\frac{19997}{215000}$=*Ans.*
430
2025
1935
901
860
410
215
1954
1935
19997

CASE IV.

(28.

$$\begin{array}{rl} 27= & \left\{\begin{array}{l} 3)\underline{3210473} \\ 9)\underline{1070157} - 2 \end{array}\right. \\ \textit{Quotient}= & \quad 118906 - 3 \end{array} \Big\} \quad \frac{(3\times 3)+2}{27}=\frac{11}{27}.$$

(29.)

$$\begin{array}{rl} 35= & \left\{\begin{array}{l} 5)\underline{7210473} \\ 7)\underline{1442094} - 3 \end{array}\right. \\ \textit{Quotient}= & \quad 206013 - 3 \end{array} \Big\} \quad \frac{(5\times 3)+3}{35}=\frac{18}{35}.$$

(30.)

$$\begin{array}{rl} 42= & \left\{\begin{array}{l} 6)\underline{6251043} \\ 7)\underline{1041840} - 3 \end{array}\right. \\ \textit{Quotient}= & \quad 148834 - 2 \end{array} \Big\} \quad \frac{(6\times 2)+3}{42}=\frac{15}{42}.$$

(31.)

$$\begin{array}{rl} 54= & \left\{\begin{array}{l} 6)\underline{5761031} \\ 9)\underline{\ 960172} - 2 \end{array}\right. \\ \textit{Quotient}= & \quad 106685 - 7 \end{array} \Big\} \quad \frac{(6\times 7)+2}{54}=\frac{44}{54}.$$

When the learner is sufficiently perfect in division, he may subtract each figure of the product, as he proceeds, writing down only the remainders.

This is called the Italian method, and is generally practised on the Continent.

Example.

Divide 371208 by 568

$$\begin{array}{r} 568)371208(\underline{\underline{653}} \\ 3040 \\ 2008 \\ \underline{\underline{304}} \end{array}$$

ADDITION OF MONEY, WEIGHTS, & MEASURES.

MONEY.

	£	*s.*	*d.*
(2.)	385	9	1¼
(3.)	388	14	0½
(4.)	379	9	4½
(5.)	2752	6	11
(6.)	2563	3	10½
(7.)	315	5	8¾
(8.)	424	11	2
(9.)	2042	7	6¾
(10.)	2168	9	3¼
(11.)	306	0	9
(12.)	164	0	2½

TROY WEIGHT.

(1.) 35 *oz.* 10 *dwts.* 2 *gr.*
(2.) 43 *oz.* 18 *dwts.* 16 *gr.*
(3.) 29 *lbs.* 9 *oz.* 5 *dwts.*
(4.) 81 *lbs.* 0 *oz.* 2 *dwts.*

AVOIRDUPOIS WEIGHT.

(1.) 1843 *lbs.* 12 *oz.* 7 *dr.*
(2.) 298 *lbs.* 10 *oz.* 5 *dr.*
(3.) 249 *cwt.* 3 *qr.* 26 *lbs.*
(4.) 35 *tons* 1 *cwt.*

APOTHECARIES' WEIGHT.

(1.) 34 *drs.* 0 *sc.* 13 *gr.*
(2.) 37 *oz.* 3 *drs.* 0 *sc.* 3 *gr.*
(3.) 51 *lbs.* 8 *oz.* 6 *drs.* 2 *sc.*
(4,) 38 *lbs.* 7 *oz.* 3 *drs.* 2 *sc.*

CLOTH MEASURE.

(1.) 307 *F. E.* 1 *qr.* 1 *n.*
(2.) 384 *yds.* 1 *qr.* 2 *n.*
(3.) 438 *yds.*
(4.) 393 *E, E.* 1 *qr.* 2 *n.*

LONG MEASURE.

(1.) 268 *ft.* 0 *in.* 1 *b. c.*
(2.) 339 *yds.*
(3.) 361 *miles* 4 *fur.* 7 *poles*
(4.) 357 *lea.* 0 *miles* 6 *feet.*

LAND MEASURE.

(1.) 272 *ac.* 3 *r.* 7 *p.*
(2.) 218 *ac.* 0 *r.* 29 *p.*
(3.) 276 *ac.* 3 *r.* 17 *p.*
(4.) 170 *ac.* 0 *r.* 3 *p.*

LIQUID MEASURE.

(1.) 310 *run.* 4 *gals.* 2 *qts.*
(2.) 293 *tier.* 21 *gals.* 3 *qts.*
(3.) 404 *hhds.* 2 *gals.* 2 *qts.*
(4.) 279 *tuns* 2 *hhds.* 22 *gals*

ALE AND BEER MEASURE.

(1.) 387 *bar.* 2 *fir.* 7 *gals.*
(2.) 351 *bar.* 2 *fir.* 4 *gals.*
(3.) 341 *hhds.* 50 *gals.* 2 *qts.*
(4.) 339 *hhds.* 14 *gals.* 3 *qts*

DRY MEASURE.

(1.) 394 *qrs.* 6 *bush.* 2 *p.*
(2.) 417 *qrs.* 3 *bush.* 1 *p.*
(3.) 479 *ch.* 6 *bush.* 1 *p.*
(4,) 412 *ch.* 3 *bush.* 1 *p.*

MEASURE OF TIME.

(1.) 338 *hrs.* 58 *m.* 48 *sec.*
(2.) 380 *days* 21 *hrs.* 5 *m.*
(3.) 373 *wks.* 5 *days* 5 *hrs.*
(4.) 380 *wks.* 5 days 18 hrs

THE APPLICATION.

Here 1785+54=1839, the date of the year.=*Ans.*

(2.)	£	*s.*	*d.*
A laid out - -	7	15	6
B laid out - -	2	9	0
C laid out - -	2	14	6
D laid out - -	0	7	3
Laid out in all	£13	6	3

(3.)	£	*s.*	*d.*
Paid for goods	54	17	0
Paid for packing	0	13	8
Paid for carriage	1	5	4
Spent - - -	0	14	3
Ans.=	£57	10	3

(4.)	£	*s.*	*d.*
Lent at different times -	63	0	0
	25	15	0
	32	7	0
	15	14	10
	99	11	6
Lent in all	£236	8	4

(5.)	£	*s.*	*d.*
A owes - -	104	5	2
B ,, - -	37	8	6
C ,, - -	48	13	6
D ,, - -	19	7	4
E ,, - -	5	0	6½
Whole Amt.	£214	14	6½

(6.)	£	*s.*	*d.*
Rent of house -	75	0	0
Poor's Rates -	12	17	6
Window and house tax -	10	10	0
Lighting and Watching -	2	17	3
Other Rates -	1	7	11
Ans.=	102	12	8

(7.)	£	*s.*	*d.*
Joiner's bill -	26	5	11
Bricklayer's and Plasterer's	15	3	7
Mason's - -	9	14	3
Slater's - -	7	12	4½
Painter's and Glazier's -	9	5	7
Ans.=	68	1	8½

(8.)	£	*s,*	*d.*
Owes to A -	346	18	4
— B -	712	18	9
— C -	209	6	3
— D -	417	16	8
— E -	200	13	7
— F -	817	0	3
— G -	512	13	6
Ans.=	3217	7	4

(9.)	£	*s.*	*d.*
Received of A -	7	5	2
— B -	15	18	6½
— C	150	13	2¼
— D -	17	6	8
— E -	6	9	2
— F -	0	6	8
— G -	76	15	9½
— H	121	12	4
Ans.=	396	7	6¼

(10.)	*Yds.*	*qrs.*	*n.*
Blue cloth -	446	3	2
Black ,, -	376	3	3
Brown ,, -	638	2	2
Scarlet ,, -	129	3	1
Mixture -	748	0	0
Other Colours	817	3	0
Received in all	3158	0	0

(11.)	*t.*	*cwt.*	*qr.*	*lb*
Hemp - -	36	0	0	0
Flax - -	5	14	3	17
Iron - -	31	18	1	24
6 Hogsheads	4	13	0	1
6 Barrels -	3	4	2	12
4 Boxes -	0	10	3	3
16 Bales -	8	15	0	19
Ans.=	90	16	3	20

(12.)		*d.*	*h.*	*m.*
The first piece was finished in		29	10	28
Second	do.	24	5	17
Third	do	19	11	22
Fourth	do.	23	4	0
Fifth	do.	17	3	25
	Ans.=	113	10	32

(13.)	*a.*	*r.*	*p.*
House and garden - - -	1	3	15
Fold, barn, &c.	1	2	17
Orchard - -	8	1	12
Great close - -	13	2	7
Little close - -	5	0	12
Arable land -	32	1	37
Meadow and pasture do. -	47	1	0
Woodlands - -	17	3	16
Area of the Estate	127	3	36

(14.)	*lbs.*	*oz.*	*d.*
Service of plate	16	11	8
Plates - - -	34	0	9
Spoons and ladles	9	4	8
Salts and castors	5	11	7
Knives and forks	6	1	5
Tea-kettle and lamp - -	10	11	7
Small articles -	15	5	5
Ans.=	98	9	9

SUBTRACTION OF MONEY, WEIGHTS, AND MEASURES.

MONEY.

	£	*s.*	*d.*
(2.)	98	1	3¾
(3.)	7	19	2¾
(4.)	2	0	6½
(5.)	7	12	8¾
(6.)	9	18	2
(7.)	64	2	6½
(8.)	22	18	1½
(9.)	51	8	8¾
(10.)	387	17	9¾

(11.)	£	*s.*	*d.*
Paid in all -	2218	7	8¾
Remains to pay - -	22889	7	10¼

(12.)	£	*s.*	*d.*
Received in all	2057	14	5
Remains due	23098	7	1

TROY WEIGHT.

(1.) Unsold 6 *oz* 0 *dwt.* 19*gr*
(2.) 18 *dwt.* 1 *gr.*
(3.) 13 *lb* 0 *oz* 11 *dwt* 19 *gr.*
(4.) 1 *lb.* 7 *oz.* 0 *dwt.* 22 *gr.*

AVOIRDUPOIS WEIGHT.

(1.) 8 *lb* 2 *oz.* 2 *dr.*
(2.) 5 *lbs.* 13 *oz.* 14 *dr.*
(3.) 10 *cwt.* 0 *qr.* 11 *lb.*
(4.) 11 *tons* 19 *cwt* 3 *qr* 2 *lb*

APOTHECARIES' WEIGHT.

(1.) 11 *oz* 6 *dr.* 2 *sc.* 14 *gr.*
(2.) 2 *oz.* 1 *dr.* 1 *sc.* 17 *gr.*
(3.) 2 *lb.* 8 *oz.* 6 *dr.* 2 *sc.*
(4.) 2 *lb.* 11 *oz.* 7 *dr.*

CLOTH MEASURE.

(1.) 18 *F. E.* 0 *qr.* 1 *n.*
(2.) 11 *yds.* 2 *qr.* 2 *n.*
(3.) 67 *yds.* 3 *qr.* 1 *n.*
(4.) 20 *E. E.* 3 *qr.* 3 *n.*

LONG MEASURE.

(1.) 7 *ft.* 10 *in.* 1 *b. c.*
(2.) 21 *yd.* 2 *ft.* 6 *in.*
(3.) 26 *m.* 1 *fur.* 33 *p.*
(4.) 21 *lea.* 1 *m.* 3 *fur.* 13 *p*

LAND MEASURE.

(1.) 16 *ac.* 1 *r.*
(2.) 1 *ac.* 3 *r.* 12 *p.*
(3.) 7 *ac.* 3 *r.* 1 *p.*
(4.) 45 *ac.* 2 *r.* 36 *p.*

LIQUID MEASURE.

(1.) 36 *run.* 17 *gal.* 3 *qt.*
(2.) 7 *tier.* 33 *gal.* 3 *qt.*
(3.) 17 *hhd.* 61 *gals.*
(4.) 43 *tun.* 2 *hhd.* 50 *gal.*

ALE AND BEER MEASURE.

(1.) 3 *bar.* 3 *fir.* 6 *gal.*
(2.) 12 *bar.* 0 *fir.* 3 *gal.*
(3.) 14 *hhd.* 30 *gal.* 3 *qt.*
(4.) 552 *hhd.*

DRY MEASURE.

(1.) 36 *qu.* 7 *bush.*
(2.) 7 *qu.* 7 *bu.* 2 *p.*
(3.) 24 *ch.* 27 *bu.* 3 *p.*
(4,) 11 *ch.* 30 *bu.* 2 *p.*

MEASURE OF TIME.

(1.) 22 *ho.* 53 *m.* 56 *sec.*
(2.) 35 *da.* 22 *ho.* 24 *m.*
(3.) 17 *mo.* 2 *wk.* 3 *da.*
(4.) 51 *mo.* 1 *wk.*

THE APPLICATION.

(1.)	
From	1851
Deduct	1792
His age	59 = *Ans.*

(2.)	£
From	1156
Deduct	737
A's debt	419 = *Ans.*

(3.)		£
	50 × 3 =	150
	10 × 4 =	40
Sum lost - - -		190

	£
Then from - - -	517
Take - - - - -	190
Sum left - - - - -	327

(4.)	£	s.
From - -	37	5
Take - -	14	14
Ans.=	22	11

(5.)	£	s.	d.
Lent 100 gui.	105	0	0
Received	42	17	3
Due to me	62	2	9

(6.)	yrs.	m	w	d
Whole term	7	0	0	0
Time served	3	9	2	5
Remains to serve	3	3	1	2

(7.)	£	s.	d.
Paid at different times - -	234	5	6
	157	16	8
	316	5	9
	95	7	8
Paid in all - - - -	803	15	7

	£	s.	d.
Then from sum borrowed -	1000	0	0
Take sum paid - - -	803	15	7
Remains to pay - - -	196	4	5

(8.)	£	s.	d.
A borrowed - -	746	9	3
	519	14	10
Amount borrowed -	1266	4	1
A paid in goods and cash -	946	13	8
A still owes - - -	319	10	5

(9.)	£	s.	d.
Cash in hand - -	12510	7	0
Cleared the first year -	452	3	6
Total - - -	12962	10	6
Owed - - -	750	0	0
Neat balance - -	£12212	10	6

(10.)	m.	f.	p.
One road measures - -	37	3	27
The other - - -	33	5	14
Difference - - - -	3	6	13

(11.)

	£	*s.*	*d.*
Household expenses	174	15	8
Rent	57	15	0
Taxes	12	14	8
Servant's Wages	54	14	0
Tradesmen's Accounts ...	39	16	8
Incidental expenses... ...	17	18	3
Yearly expenditure ...	357	14	3

	£	*s.*	*d.*
From his Income ...	742	16	4
Deduct	357	14	3
Ans.=	385	2	1

(12.)

	t	*cwt*	*qr*	*lb*
Quantity purchased ...	1	7	3	13
Sold at different times ...		3	2	6
		7	1	13
		4	0	5
		6	1	26
		2	3	17
Amount sold...	1	4	1	11
What he had left ...		3	2	2=*Ans.*

(13.)

	yd	*qr*	*n*
Sold at different times	7	3	2
	5	2	1
	7	3	3
	4	2	0
	9	2	3
Whole quan. sold	35	2	1

	yd	*qr*	*n*
Bought ...	38	2	0
Sold ...	35	2	1
Quantity rem. -	2	3	3

MULTIPLICATION OF SEVERAL DENOMINATIONS.

£ s. d.
(2.) 226 - 19 - 4½
(3.) 249 - 1 - 5
(4.) 285 - 11 - 11¾
lb oz dwt gr
(5.) 59 - 5 - 0 - 4
tons cwt qr lb
(6.) 203 - 0 - 0 - 8
yds qrs
(7.) 152 - 3

m. fur p.
(8.) 184 - 3 - 25
a. r. p.
(9.) 67 - 2 - 9
bar f. gal
(10.) 227 - 0 - 4
bar f. gal
(11.) 80 - 0 - 3
m. fur p.
(12.) 271 - 2 - 5

The Practical Questions.

s. d.
(3.) 7 8½
7 × 3 = 21
2 13 11½
3
£8 1 10½ = *Ans.*

(4.) 15 3½
11 × 3 + 1 = 34
8 8 2½
3
25 4 7½
15 3½ top line add
£25 19 11 = *Ans.*

(5.) 7 2¾
5 × 5 × 3 = 75
1 16 1¾
5
9 0 8¾
3
£27 2 2¼ = *Ans.*

s. *d.*
(6.) 9 7
6 × 6 + 1 = 37
2 17 6
6
17 5 0
9 7, top line add
£17 14 7 = *Ans.*

£ *s. d.*
(7.) 1 5 3
12 × 8 + 1 = 97
15 3 0
8
121 4 0
1 5 3, top line add
£122 9 3 = *Ans.*

THE PRACTICAL QUESTIONS.

s. *d.*
(8.) 6 4
6×7+1=43
1 18 0
7
13 6 0
6 4, top line add.
£13 12 4=*Ans.*

(9.) 12 3
11×11+6=127
6 14 9
11
74 2 3
3 13 6, top line ×6.
£77 15 9=*Ans.*

(10.) 7 5
9×5×3=135
3 6 9
5
16 13 9
3
£50 1 3=*Ans.*

(11.) 1 4½
12×6+2=74
16 6
6
4 19 0
2 9, top line ×2
£5 1 9=*Ans.*

(12.) 1 10
12
1 2 0, price of 1 doz.
6
£6 12 0=*Ans.*

s. *d.*
(13.) 3 4½
5×5+½=25½.
16 10½
5
4 4 4½
1 8¼, ½ top line add
£4 6 0¾=*Ans.*

(14.) 1 3
5×5×3+½
6 3
5
1 11 3
3
4 13 9
7½, ½ top line add
£4 14 4½=*Ans.*

(15.) 4 3
2×10—½=19½
8 6
10
4 5 0
2 1½, ½ top line sub
£4 2 10½=*Ans.*

(16.) 1 4
7×5+¼=35¼
9 4
5
2 6 8
4, ¼ top line add.
£2 7 0=*Ans.*

£ s. d.
(17.) 1 1 6
7¼
7 10 6
5 4½, ¼ top line add
£7 15 10½ = *Ans.*

(18.) 3 15 7
6½
22 13 6
1 17 9½, ½ top line add
£24 11 3½ = *Ans*

(19.) 4 15 6
7 × 5 + ½ = 35½
33 8 6
5
167 2 6
2 7 9, ½ top line add
£169 10 3 = *Ans.*

20.) 4 17 10
11 × 7 × 2 + ½ = 154½
53 16 2
7
376 13 2
2
753 6 4
2 8 11, ½ top line add
£755 15 3 = *Ans.*

21.) 12 6
10 × 11 + 7¼ = 117¼
6 5 0
11
68 15 0
4 7 6, top line × 7.
3 1½, ¼ top line add
£73 5 7½ = *Ans.*

£ s. d.
(22.) 1 7 8
8 × 10 + 5¾ = 85¾
11 1 4
10
110 13 4
6 18 4, top line × 5
1 0 9, ¾ top line add
£118 12 5 = *Ans.*

(23.) 1 3 6
10 × 3 − ¾ = 29¼
11 15 0
3
35 5 0
17 7½, ¾ top line sub
£34 7 4½ = *Ans.*

£ s.
(24.) 1 3
3 × 6 − ¼ = 17¾
3 9
6
20 14
5 9, ¼ top line sub.
£20 8 3 = *Ans.*

s. d.
(25.) 12 4
6 × 6 + 1½ = 37½
3 14 0
6
22 4 0
12 4, top line.
6 2, ½ top line add.
£23 2 6 = *Ans.*

	£	s.	d.	
(26.)	2	18	7	
			$7\times8+\frac{3}{4}=56\frac{3}{4}$	
	20	10	1	
			8	
	164	0	8	
	2	3	$11\frac{1}{4}$,	$\frac{3}{4}$ topline add
	£166	4	$7\frac{1}{4}$	= *Ans.*

	£	s.	d.	
(27.)	2	15	6	
			$12\times8+\frac{1}{2}=96\frac{1}{2}$	
	33	6	0	
			8	
	266	8	0	
	1	7	9,	$\frac{1}{2}$ top line add
	£267	15	9	= *Ans.*

	£	s.	d.	
(28.)		18	6	
			$9\times5+\frac{3}{4}=45\frac{3}{4}$	
	8	6	6	
			5	
	41	12	6	
		13	$10\frac{1}{2}$,	$\frac{3}{4}$ topline add
	£42	6	$4\frac{1}{2}$	= *Ans.*

	£	s.	d.	
(29.)		4	3	
			$8\times11-\frac{1}{4}=87\frac{3}{4}$	
	1	14	0	
			11	
	18	14	0	
		1	$0\frac{3}{4}$,	$\frac{1}{4}$ topline sub
	£18	12	$11\frac{1}{4}$	= *Ans*

	£	s.	d.	
(30.)	4	7	6	
			$12\times10+\frac{3}{4}=120\frac{3}{4}$	
	52	10	0	
			10	
	525	0	0	
	3	5	$7\frac{1}{2}$,	$\frac{3}{4}$ topline add
	£528	5	$7\frac{1}{2}$	= *Ans.*

THE APPLICATION.

	£	s.	d.	
(1.)	3	7	4	
			9	
	£30	6	0	= *Ans.*

	£	s.	d.	
(2.)	10	11	6	
			12	
	£126	18	0	= *Ans.*

	£	s.	d.	
(3.)		5	4	
			$9\times7=63$	
	2	8	0	
			7	
	£16	16	0	= *Ans.*

	£	s.	d.	
(4.)		12	8	
			$12\times6=72$	
	7	12	0	
			6	
	£45	12	0	= *Ans.*

	£	*s.*	*d.*	
(4.)	14	6	8½	
			6	× 3 = 18
	86	0	3	
			3	
	£258	0	9	= *Ans.*

	qrs.	*bu.*	*p.*	
(6.)	7	5	3	
			8	× 8 = 64
	61	6	0	
			8	
	494	0	0	

	£	*s.*	*d.*	
(7.)	9	7	8½	
			4	× 4 = 16
	37	10	10	
			4	
	£150	3	4	= *Ans.*

	£	*s.*	*d.*	
(8.)	318	7	6	
			7	× 5 = 35
	2228	12	6	
			5	
Sum paid.	11143	2	6	= *Ans.*

	m.	*fur*	*p*	
(9.)	7	6	17	
			6	× 4 = 24
	46	6	22	
			4	
Dis. run	187	2	8	= *Ans.*

	£	*s.*	*d.*	
(10.)		14	3	
			9	× 7 = 63
	6	8	3	
			7	
Cost of 1 hhd.	44	17	9	= *Ans.*

	lbs	*oz*	*dwt*	*gr*	
(11.)	2	8	7	5	
				5	× 3
	13	5	16	1	
				3	
	40	5	8	3	= *A.*

		s.	*d.*	
(12.)		8	9	
			10	× 5 + 2 = 52
	4	7	6	
			5	
	21	17	6	
		17	6	
A. =	£22	15	0	yearly amt.

		s.	*d.*	
(13.)		7	6	
			11	× 11 × 3 + 2 = 365
	4	2	6	
			11	
	45	7	6	
			3	
	136	2	6	
		15	0	
	£136	17	6	Sum laid by.

	t.	*cwt*	*qr*	*lbs*	
14.)	0	3	2	17	
				12	×7+3=87
	2	3	3	8	
				7	
	15	6	3	0	
		10	3	23	
Ans.=	15	17	2	23	Weight of the whole.

	£	*s.*	*d.*	
(15.)	125	15	6	
			10	×5×5=250
	1257	15	0	
			5	
	6288	15	0	
			5	
	£31443	15	0	=*Ans.*

		£	*s.*	*d.*	
(16.)	Wages	1	1	0	
	Expenses		15	4½	
	Sum saved Weekly		5	7½	
				10	×5+2=52
		2	16	3	
				5	
		14	1	3	
			11	3	
	Amount saved Annually,	£14	12	6	=*Ans.*

(17.) Here 9×396×42×38=5688144=*Ans.*

(18.)

	£	s.	d.	
	1	12	6	
			11	×11 ×3+2=365
	17	17	6	
			11	
	196	12	6	
			3	
	589	17	6	
	3	5	0	
	593	2	6	Spends per year.
	294	12	6	Lays up per year.
Ans.=	£887	15	0	Annual income.

(19,)

	£	s.	d.		£	s.	d.	
First	1086	0	0	×5=	5430	0	0	what he cleared the first five years.
And	2715	10	6	×4=	10862	2	0	what he cleared the next four years.
Add					19118	0	0	what he began trade with.
					£35410	2	0	his fortune at nine years' end.
Again	£475	4	6	×3=	1425	13	6	lost the last three years in trade.
				Ans.=	£33984	8	6	his real fortune at twelve years' end.

(20.)

	£	s.	d.		£	s.	d.
First	37	14	2	×4=	150	16	8
Then	31	4	2	×4=	124	16	8
And	18	12	6	×4=	74	10	0
What the parishes, &c., paid					£350	3	4
Then from - - -					386	15	6
Take - - - -					350	3	4
Deficiency - - -					£ 36	12	2=*Ans.*

DIVISION OF SEVERAL DENOMINATIONS.

```
        £  s.  d.          £  s.  d.         £  s.  d.
(2.)   12  9  2¼+   (3.)  14  6  4¼   (4.)  10  9  4¾+

      lb  oz dwt gr        lb  oz  dr         cwt qrs lb oz
(5.)  12  6  11  4+  (6.)  5   2   1+  (7.)  13   3   5  2

        yds qrs n              m.  f.  p.
(8.)     3   3  3       (9.)   7   5   6+

       yds. f. in. b.c.            bar. fir. gal.
(10.)   6   2   8   1+       (11.)  2    3    7+

        bar. fir. gal.                ch.  bu. pk.
(12.)  13)55  3   7(4 bar.    (13.)  14)357  2   1(25 ch.
          52                            28
          --                            --
           3                            77
           4                            70
          --                            --
       13)15(1 fir.                      7
          13                            32
          --                        14)226(16 bu.
           2                           14
           9                           --
          --                            86
       13)25(1 gal.                     84
          13                            --
          --                             2 rem,
          12                            ==
           4
          --
       13)48(3 qts.
          39
          --
           9 rem.
          ==
```

THE APPLICATION.

```
                                                £   s.  d.
         £     s.   d.              (2.)  35 { 7)57   3   7
(1.)  12)257   2    5                          ---------------
      -----------------                        5)  8   3   4¼
      £ 21     8    6¼+=*A*.                       ------------
      =================                        £  1  12   8=*Ans*.
                                                  ==========
```

(3.) £ s. d.
9)37 6 $4\frac{3}{4}$
£ 4 2 11 +=*Ans.*

(4.) £ s. d.
$20\begin{cases}2)27\ 5\ 4\frac{1}{2}\\10)13\ 12\ 8\frac{1}{4}\end{cases}$
£ 1 7 3=*Ans.*

(5.) £ s. d.
$120\begin{cases}10)154\ 17\ 10\\12)\ 15\ 9\ 9\frac{1}{4}\end{cases}$
Ans.=£ 1 5 $9\frac{3}{4}$+

(6.) £ s. d.
$72\begin{cases}6)85\ 6\ 0\\12)14\ 4\ 4\end{cases}$
Ans.= £ 1 3 $8\frac{1}{4}$+

(7.) £ s. d.
$18\begin{cases}6)275\ 3\ 4\\3)\ 45\ 17\ 2\frac{1}{2}\end{cases}$
Ans.=£ 15 5 $8\frac{3}{4}$+

(8.) £ s. d.
$500\begin{cases}10)7257\ 3\ 6\\10)\ 725\ 14\ 4\\5)\ 72\ 11\ 5\end{cases}$
Ans.= £ 14 10 $3\frac{1}{4}$+

(9.) Here 2515÷509=5, the number of bullocks each man had; hence 9*l.* 14*s.* 6*d.* × 5=48*l.* 12*s* 6*d.* the value of each man's share

(10.) *yds.*
$35\begin{cases}7)9625\\5)1375\end{cases}$
275 *yards*=*Ans.*

(11.) £ s.
$25\begin{cases}5)10\ 0\\5)\ 2\ 0\end{cases}$
8 each man's con-[tribution.

£
$25\begin{cases}5)4000\\5)\ 800\end{cases}$
£ 160 each man's [share.

(12.) £
17)1156(68*l.*=*Ans.*
102
136
136

(13.) £
2805
2
$7\frac{1}{2}=15\begin{cases}5)2610\\3)1122\end{cases}$
£ 374=*Ans*

14.) Here $240-(4429\div43)=240-103=137$, the number required.

(15.) Here it is evident by the question that B must have ⅓ of the share, because A is to have 2*s.* less, and C 2*s.* more than B; consequently

$$\begin{array}{rl} \text{B's share} & =20s.\div3=6s.\ 8d. \\ \therefore\ \text{C's share} & =6s.\ 8d.+2s.=8s.\ 8d. \\ \text{and A's share} & =6s.\ 8d.-2s.=4s.\ 8d. \\ & \qquad\qquad\quad \overline{20s.\ 0d.}\ \textit{Proof.} \end{array}$$

(16.) Here $3013248\div7847=384$, the number required.

(17.) Here $5840\div365=16$, the number of miles per day.

(18.)
$$\begin{array}{lrrrr} & & \pounds & s. & d. \\ 96\,\big\{ & 12) & 58 & 12 & 0 \\ & 8) & 4 & 17 & 8 \\ \hline \textit{Ans.}= & & & 12 & 2\tfrac{1}{2} \end{array}\ \text{per ream}$$

(19.)
$$\begin{array}{lrrrr} & & oz & dwts & qrs \\ 36\,\big\{ & 12) & 29 & 14 & 0 \\ & 3) & 2 & 9 & 12 \\ \hline \textit{Ans.}= & & & 16 & 12 \end{array}\ \text{weight of each spoon}$$

(20.) It is evident from the nature of the question, that four women must have as much as two men, therefore, $5+2=7$, the first divisor.

$$\begin{array}{rrrr} & \pounds & s. & d. \\ 7) & 120 & 10 & 11 \\ 2) & 17 & 4 & 5, \\ & 8 & 12 & 2\tfrac{1}{2}, \end{array}\begin{array}{l} \\ \\ \text{each man's share.} \\ \text{each woman's share.} \end{array}$$

(21.)
$$\begin{array}{lrrrr} & & \pounds & s. & d. \\ 63\,\big\{ & 9) & 43 & 6 & 3 \\ & 7) & 4 & 16 & 3 \\ \hline \textit{Ans.}= & & & 13 & 9, \end{array}\ \text{per gallon.}$$

(22.)

gui.
20
21 *s.* *d.*
365)420(1 1¾=*Ans.*
365
55
12
365)660(1
365
295
4
365)1180(3
1095
85 *rem.*

(23.)

		t.	*cwt.*	*qrs.*	*lbs.*
75	3)	13	10	2	4
	5)	4	10	0	20
	5)		18	0	4
Ans.=			3	2	12, weight of one package.

(24.) Here £800÷365=£2 3*s.* 10*d.* per day. 10 *rem.* And £2 3*s.* 10*d.*×7=£15 6s. 10*d*, per week. Also, £15 6*s.* 10*d.*×4=£61 7*s.* 4*d.* per month.

(25.)

cwt. *qrs.* *lbs.*
18 2 16
4
74
28
18 { 2)2088
9)1044
Ans.= 116, parcels.

(26.)

£ *s.* *d.*
6 6 8
20
126
12
s. *d.* = *d.*
3 4 = 4,0)152,0
Ans. = 38 persons.

(27.)

£ s. *d.*
2 13 8
20
53
12
lbs.
1 *cwt.* = 112)644(5¾*d.* per lb. = *Ans.*
560
84
4
112)336(3
336

(28.)

£ £ *s.* *d.*
95)218(2 5 10½ = *Ans.*
190
28
20
95)560(5
475
85
12
95)1020(10
950
70
4
95)280(2
190
90 *rem.*

(29.

£	s.
16	2
20	
322	
12	

736)3864(5¼*d.* per yard=*Ans.*
3680
184
4
736) 736(1
736

(30.) Here 500 *gui.*=£525.

And £525÷17=£30 17*s*, 7¾*d.* 1 *rem.*=*Ans.*

BILLS OF PARCELS.

	£	s.	d.		£	s	d.		£	s.	d.
(1.)	1	16	0	(2.)	7	2	6	(3.)	2	10	0
		15	10		13	12	0		4	19	0
	2	2	0		11	16	0		4	0	0
	1	5	0		2	10	8		2	14	0
	1	10	0		17	17	6		1	2	2
		3	4		7	3	9		1	19	4½
	£7	12	2=*Ans*		£62	2	5=*Ans*		£17	4	6½=*A.*

	£	s.	d.		£	s.	d.		£	s.	d.
(4)	11	0	6	(5.)	3	3	9	(6.)	5	1	3
		10	10		8	2	0		5	18	9
	3	0	0		16	10	0		3	0	0
	2	2	0		14	8	0		8	12	6
	6	6	0		2	3	9		8	19	11
		15	0		14	17	6		7	5	0
	£23	14	4=*Ans*		£59	5	0=*Ans*		£38	17	5=*Ans*

(7.)

£	s.	d.
	13	6½
	14	4½
	8	6
	11	8
	6	10½
	12	10
£3	2	9½=*Ans*

(8.)

£	s.	d.
	4	0
	5	8
	12	10
2	2	4
	3	9
	11	0
£3	19	7=*Ans*

(9.)

£	s.	d.
1	14	10
3	8	3
2	16	0
5	12	0
8	15	0
1	1	3
£23	7	4=*Ans*

REDUCTION DESCENDING.

(2.)

£	
12	
20	
240	*shillings.*
12	
2880	*pence.*
4	
11520	*farthings.*

(3.)

£	
18	
20	
360	*shillings.*
12	
4320	*pence.*
4	
17280	*farthings.*

(4.)

£	s.	
7	5	
20		
145		*shillings.*
12		
1740		*pence.*

(5.)

gs.	
21	
21	
441	
12	
5292	
4	
21168	*farthings.*

(6.)

£	s.	d.	
17	5	3¼	
20			
345			
12			
4143			
4			
16573			*farthings.*

(7.)

£	s.	
25	14	
20		
514		*shillings.*
12		
6168		*pence.*

(8.)

cr.	
15	
5	
72	*shillings.*
2	
150	*sixpences.*

(9.)

£	
25	
4	
100	*crowns.*
5	
500	*shillings.*

(10.)

h.cr.	
75	
30	
1710	
4	
6840	*farthings.*

d.
(11.) 52 *crowns*=3120
52 *half-crowns*=1560
52 *shillings*= 624
and+ 52
sum=5356
4
21424 *farthings.*

£
(12.) 75
8
600 *half-crowns.*
5
3000 *sixpences.*
2
6000 *threepences.*

REDUCTION ASCENDING.

qrs.
(14.) 4)11520
2)2880*d.*
2,0)24,0*s.*
12*l.*

qrs.
(15.) 4)17280
12)4320*d.*
2,0)36,0*s.*
18*l.*

d.
(16.) 12)1740
2,0)145*s.*
£ 7.5.

qrs,
(17) 4)21168
12)5292
21 { 3) 441
7) 147
21 *qrs.*

qrs.
(18.) 4)16573
12)4143¼
2,0) 34,5.3
Ans.=£ 17.5.4¼

d.
(19.) 12)6168
2,0)51,4
Ans.=£ 25.14

d.
(20.) 12)900
5)75*s.*
15*cr.*

s.
(21.) 5)500
4)100*cr.*
25*l.*

qrs.
(22.) 4)6840
3.0)171,0*d.*
57*half-cr.*

(23.) 60*d.*+30*d.*+12*d.*+1*d.*=
103*d.*=412 *qrs.*; hence
21424 *qrs.*÷412=52, the
number of each required.

(24.) 2)6000 *threepences.*
5)3000 *sixpences.*
8)600 *half-crowns*
75*l.*

ASCENDING AND DESCENDING.

(20.)
s.
5)130
26*crs.*
60
1560*d.*

(27.)
gs.
60
21
5)1260*s.*
4)252*cr.*
63*l.*

(28.)
£
63
4
252 *crowns.*
5
21 { 3)1260 *shillings.*
7) 420
60 *guineas.*

(29.)
h. sovs.
76
10
5)760 *shillings.*
152 *crowns.*

(30.)
crs.
2)152
76 *half-sovs.*
10
760 *shillings.*

(31.) 60*d.* + 30*d.* + 12*d.*= 102*d.* the divisor, and £536=133440*d.* the dividend; then 133440 ÷102=1308 of each, and 2*s.* over.

(32.)
1308 *hlf-crs.*=3270
1308 *crowus*=6540.
to which add 1308
2,0)1111,8
£ 555,18

(33)
£ *s.*
15 10
7
108 10 they brought in.
20
21)2170(103 *guineas.*
21
70
63
7*s.* *over,*

(34.
gs, *s.*
103 7
21
2,0)217,0
7)108 10
£ 15 10 *each.*

(35.)
12 *guineas* =12 12
1 *crown* = 5
Half-sovereign = 10
In each purse 13 7
5 × 5=25
66 15
5
Ans.=£333 15

(36.) First 3)£50 *s.* 0 *d.* 0

16 13 4 = 4000*d.*; the $\frac{1}{60}$ of which is 66, number of men, with a remainder of 3*s.* 4*d.*

Then 4)£50 *s.* 0

12 10 = 3000*d.*; the $\frac{1}{30}$ of which is 100, number of women.

And 5)£50

10 = 200*s.*; the number of boys.

Also 6)£50 *s.* 0 *d.* 0

8 6 8 = 2000*d.*; the $\frac{1}{9}$ of which is 222, number of girls, with a remainder of 2*d.*

	£	*s.*	*d.*
Which being added, gives the	16	13	4
	12	10	0
	10	0	0
	8	6	8
total bequeath	£47	10	0

And 50*l.* − 47*l.* 10*s.* = 2*l.* 10*s*; hence 2*l.* 10*s.* + 3*s.* 6*d.* = 2*l.* 13*s.* 6*d.* what the distributor is to have for his pains.

TROY WEIGHT.

(37.)
oz.
27
20
540
24
12960 *gr.*

(38.)
gr.
24 { 4)12960
 { 6) 3240
2,0)54,0
27 *oz.*

(39.)
lb. *oz.* *dwt* *gr*
3 10 7 5
12
46
20
927
24
22253 *gr.*

	lb.	*oz.*	*dwt.*	*gr.*
(40.)	7	4	17	15
				8
	59	3	1	0=8 *ingots.*
	12			
	711 *oz.*			
	20			
	14221 *dwt.*			
	24			
	341304 *gr.*			

	lb.	*oz.*	*dwt.*	*gr.*
(41.)	7	4	17	15
	12			
	88			
	20			
	1777			
	24			
	42663)341304(8 *ingots.*=*A.*			
	341304			

	lb.	*oz.*	*dwt.*
(42.)	23	5	7
			7
	164	1	9=7 *ingots.*
	12		
	1969		
	20		
	39389		
	24		
	945336 *gr.*		

(43.) First 2 *oz.* 16 *dwts* = 56 *dwts.* the weight of a spoon, and 50 *oz.* 8 *dwts.*=1008 *dwts.* the weight of the tankard; then 1008÷56=18, the number of spoons he must have.

		lb.	*dwt*	*gr.*
(44.)	Weight of a tankard=	17	15	6
—	spoon =	21	11	13
—	salt =	3	10	0
—	fork =	21	11	13
	Sum	64	8	8=30920 *gr.*

divisor; and 137 *oz.* 6 *dwt.* 9 *gr.*=65913 *gr.* the dividend; therefore 30920)65913(2 *of each sort.*

61840

Rem. 4073=8 *oz.* 9 *dwt.* 17 *gr. over.*

AVOIRDUPOISE WEIGHT.

oz.
(45.) 16 { 4)14769
4) 3692-1 *oz.*
112)923(8 *cwt.*
896
27 *lb.*

cwt. *qr.* *lb.* *oz.*
(46.) 8 0 27 1
4
32 *qr.*
28
923 *lb.*
16
14769 *oz.*

cwt. *qr.* *lb.*
(47.) 2 1 14
8
19 0 0
4
76 0 0=weight of 32 bags.
1 1 10=150 *lb.* add.
77 1 10=*Ans.*

ton *cwt.* *qr.* *lb.*
(48.) 34 17 1 19
20
697
4
2789
28
78111 *lb* =*Ans.*

(49.) 350 *lb.* × 3÷2==525 *common lbs.*=*Ans.*

cwt,
(50.) 27
4
108
28
18)3024(168 *parcels.*=*Ans.*
18
122
108
144
144

cwt. *qr.* *lb.*
(51.) 9 2 14
4
38 *cwt.*
28
1078 *lb.*

(52.) 547 *lb.* × 3 ÷ 2 = 820½ *common lbs.* = *Ans.*

(53.)

	cwt.	*qr.*	*lb.*	
	2	1	15	
			3 × 9 = 27	
	7	0	17	
			9	
	64	1	13	= 27 *bags.*
137 *lb.* =	1	0	25	= 1 *bag.*
	65	2	10	= *Ans.*

(54.)

cwt.	*qr*
8	3
	3 × 9 = 27
26	1
	9
236	1
4	
945	
28	
26460 *lb.*	

(55.) 552 *lb.* × 2 ÷ 3 = 368 *great lbs.* = *Ans.*

(56.)

lb.	*oz.*
16	2
16	
258 divisor.	

	cwt.	*qr.*	*lb.*
and	16	1	15
	4		
	65		
	28		
	1835		
	16		

258)29360(113 *parcels.*
258
356
258
980
774
16)206(12 *lb.*
192
14 *oz.*

APOTHECARIES' WEIGHT.

lb. ℥. ʒ. ℈. *gr.*
(57.) 27 7 2 1 2
12
331 *ounces.*
8
2650 *drams.*
3
7951 *scruples.*
20
159022 *grains.*

gr.
(58.) 2,0)15902,2 *gr.*
3) 7951
8) 2650 1℈
12) 331 2ʒ
Ans=27*lb.* 7℥ 2ʒ 1℈ 2 *grs.*

CLOTH MEASURE.

yds.
(59.) 27
4
108
4
432 *nails.*=*Ans.*

E.e.
(60.) 75
5
4)375
Ans. =93*yds.* 3 *qrs.*

yds. qr.
(61.) 93 3
3
5)375
75 *E.e.*=*A.*

pieces.
(62.) 24
32
768
3
5)2304
460 *E.e.* 4 *qrs.*

E e.
(63.) 27
17
189
27
459
3
4)1377
344 *yds.* 1 *qr.*

ells.Eng.
(64.) 27
27
729
5
4)3645
911 *yds.* 1 *qr.*

yds. qr.
(65.) 911 1
4
5)3645
729 *E.e.*=*Ans.*

pieces.
(66.) 25
12
300
15
4500
5
4)22500
5625 *yds.*=*Ans.*

LONG MEASURE.

(67.)
m.
57
8
456 *fur.*
40
18240 *poles.*

(68.)
ft.
5280 *in a mile.*
7
36960 *feet.*
12
443520 *inches.*
3
1330560 *barleycorns.*

(69.)
poles.
40)18240
8) 456 *fu*
57 *mi*

(70.)
yds.
1760 *in a mile.*
3
5280 *yards in a league.*
72
10560
36960
380160 *yds.=Ans.*

(71,)
yds. *m.*
1760)380160(216=72 *leagu*
3520
2816
1760
10560
10560

(72.)
leag.
50
3
150 *miles.*
8
1200
40
48000
5½
240000
24000
264000 *yards.*
3
792000 *feet.*
12
9504000 *inches.*
3
28512000 *barleycorns.*

(73.)
deg.
360
69½
3240
2160
180=½ *top line.*
25020 *miles.*
190080 *borleycorns in a mil*
20016
22518
2502
4755801600 *b.c.=Ans.*

LAND MEASURE.

(74.) *a.* 27
4
108 *rds.*
40
1320 *perches.*

(75.) 4,0)432,0
4)108 *roods.*
Ans.=27 *acres.*

(76.) *From* 37 *a.* 0 *r.* 1 *p.*
take 15 0 0
differen. 22 0 1
4
88
40
3521 *No. of prch. left*

(77.)

a.	*r.*	*p.*	
5	0	0 *first*	*field contains.*
4	0	2 *second*	
7	3	0 *third*	
2	1	0 *fourth*	
19	0	2=*sum.*	

4
76
40
3042 *perches; then* 3042÷75=40 *shares,* 42 *perches,*

LIQUID MEASURE.

(78.) *gals.*
276 *in a tun of port wine.*
5
1380 *gal. in* 5 *ditto.*
8
11040 *pints.*

(79.) *pints.*
8)11040
276) 1380(5 *tuns.*
1380

(80.) First, a pipe and a hogshead of sherry are=130+65=195 gallons, the divisor; whence 8190÷195=42 *of each sort.*=*Ans.*

qts.
(81.) 504 *in a pipe of clar.*
2
3)1008
12) 336 *quarts.*
28 *doz. quart bottles.*

qts.
Then from 504
take 336
difference 168
2
12)336 *pints*
28 *doz. pint bottles.*

ALE AND BEER MEASURE.

b. bar.
(82.) 46
36
1656
8
13248 *pints*

a. bar.
(83.) 10
36
360 *gals.*
4
1440 *qts.*

(84.) *hhds.*
72
3
2)216
108 *bar.*

bar.
(85.) 108
2
3)216
72 *hhds*

CORN AND DRY MEASURE.

qu.
(86.) 120
8
960 *bushels.*
4
3840 *pecks.*
2
7680 *gallons.*
4
30720 *quarts.*

(87.) *First* 64 × 4=256 *qts. in a quarter,*
then 256)30720(120 *quarters.*

ch.
(88.) 20
36 *bush. in a chaldron.*
720
4
2880 *pecks.*

lasts
(89.) 273
320 *pecks in a last.*
87360 *pecks.*

MEASURE OF TIME.

hours. weeks.
(90.) 168)72015(428
672
481
336
1455
1344
24)111(4 *days.*
96
15 *hours.*

years.
(91.) 1848
365¼
9240
11088
5544
462
Ans.=674982 *days.*

(92.) First 1108+1794=2902 years since; which
multiplied by 8766 hours in a year,
17412
14712
20314
23216
gives 25438932 *hours*, the *Ans*.

(93.) Here (by Table, page 188 Arith.) we have from the 17th of November, 1738, to the 17th of September, 1739, 304 days, being 5 days more than the number we want, ∴ 394−5=299 *days*.=*Ans*.

(94.) First 1750−1723=27 years, the time betwixt July 18th, 1723, and July 18th, 1750; but betwixt April 18th, and July 18th, are 91 days, therefore the time is 26 years and 274¼ *days*=26 *years*, 9 *mo*. 3 *wk*. 1 *day*, 6 *hours*.

days.
Again, 365¼ *in a year:*
which multiplied by 26
gives 9496½
to which add 274¼
and the sum= 9770¾ *is the number of days required.*

SINGLE RULE OF THREE DIRECT.

gal. d. gal.
(3.) *(By Rule I.)* As 1 : 3 ∷ 36
3
12)108
9*s*.=*Ans*.

(4.) Stated thus *(by Rule I.,)* if 1 *p*. : 4½*s*. ∷ 144 *p*. (=12 *doz*.) then 144×4½=648*s*. which divided by 20, will give 32*l* 8*s*.=*Answer*.

(5.) Stated thus *(by Rule II.,)* if (12 *doz.*=) 144 *p.* : 1 *p.* : : 32*l.* 8*s.* then 32*l.* 8*s.* × 20=648*s.* which divided by 144, will give 4*s.* 6*d.*=*Answer.*

(6.) Stated thus *(by Rule I.,)* if 1 *yd.* : 15½*s.* : : 32 *yds.* then 32 × 15½=496*s.* which divided by 20, will give 24*l.* 16*s.*=*Answer.*

(7.) Stated thus *(by Rule II.,)* if 32 *yds.* : 1 *yd.* : : 24*l.* 16*s.* then 24*l.* 16s. × 20=496*s.* which divided by 32, will give 15*s.* 6*d.*=*Answer.*

(8.) Stated thus, if 1 *lb.* : 10½*d.* : : 112 *lb.* then 112 × 10½=1176*d.* which divided by 12 and 20, will give 4*l.* 18*s.* =*Answer.*

(9.) Stated thus, if 112 *lb.* : 4*l.* 18*s.* : : 1 *lb.* then 4*l.* 18*s.* × 20 and 12=1176*d.* which divided by 112, will give 10½*d.*=*Answer.*

(10.) Stated thus, if 1 *ell* : 400 *ells* : : 12½*s.*; then 400 × 12½=5000*s.* which divided by 20, will give 250*l.*=*Answer.*

(11.) Stated thus, if 400 *ells* : 250*l.* : : 1 *ell*; then 250 × 20=5000*s.* which divided by 400, will give 12*s.* 6d. =*Answer.*

(12.) First 25 *cwt.* 3 *qrs.* 14 *lb.*=2898 *lb.*; stated thus, if 1 *lb.* : 15½*d.* : : 2898 *lb.* then 2898 × 15½*d*=44919*d.* which divided by 12 and 20, will give 187*l.* 3*s.* 3*d.*=*Ans.*

(13.) Stated thus, if 2898 *lb.* : 1 *lb.* : : 187*l.* 3*s.* 3*d.* then

$$\frac{187l.\ 3s.\ 3d.}{2898}=1s.\ 3\tfrac{1}{2}d.=\textit{Answer}.$$

(14.) Stated thus, if 1 *yd.* : 27¼ *yds.* : : 6*s.* 9½*d.* then 6*s.* 9½*d.* × 27¼=9*l.* 5*s.* 0¾*d.*-2.=*Answer.*

(15.) First 17 *cwt.* 1 *qr.* 14 *lb.*=1946 *lb.*; stated thus, if 1 *lb.* : 3¼*d.* : : 1946 *lb.* then 1946 × 3¼=6324½*d.* which divided by 12 and 20, will give 26*l.* 7*s.* 0½*d.*=*Answer.*

(16.) Stated thus, if 1 *oz.* : 5½*d.* : : 3584 *oz.*=2 *cwt.* then 3584 × 5½=19712*d.* which divided by 12 and 20, will give 82*l.* 2*s.* 8*d.*=*Answer.*

(17.) First 2*l.* 14*s.* 3*d.*=2604 *q.* and 21*l.* 11*s* 1½*d.*= 20694 *q.*; then state it thus, if 2604 *q.* : 3½*d.* : : 20694 *q.* then 20694 × 3½=72429, which divided by 2604, will give 27 *yds.* 3 *q.* 1 *n.* 84 *rem.*=*Answer.*

(18.) Stated thus, if (3½*lb.*=) 7 *half lb.* : 13*d.* : : 224 *half lb.* (=112 *lb.*) then 224 × 13=2912*d.* which divided by 7, 12, and 20, will give 1*l.* 14*s.* 8*d.*=*Answer.*

(19.) Stated thus, if 112 *lb.* : 416*d.*=1*l.* 14*s.* 8*d.*::3½ *lb.* then 416×3½=1456*d.* which divided by 112, will give 13*d.* =*Answer.*

(20,) First 1 *cwt.* 24 *lb.* 8 *oz.*=2184 *oz.* and 1 *cwt.*= 1792 *oz.*; then state it thus, if 1792 *oz*, : 9*s.*::2184 *oz.* then 2184×9=19656*s.* which divided by 1792, will give 10*s.* 11½*d.*-826 *rem.*=*Answer.*

(21.) Stated thus, if 2184 *oz.* : 10*s.* 11½*d.*-896 :: 1792 *oz.* then 10*s.* 11½*d.*-896=526 *q.*-896, which multiplied by 1792, and divided by 2184. will give 432 *q.* =9*s.* =*Answer.*

(22.) Stated thus, if 1*d.* : 232*d.* (=19*s.* 4*d.*) :: 365*d.* then 365×232=84680*d.* which divided by 12 and 20, will give 352*l.* 16*s.* 8*d.* what the gentleman spent, then 500*l.* —352*l.* 16*s*, 8*d.*=147*l.* 3*s.* 4*d.*=*Answer.*

(23.) Stated thus, if (2520*d.*=) 10*l.* 10*s.* : 18⅔ *F.e.* (= 14 *yds.*) :: 68130*d.* (=283*l.* 17*s.* 6*d.*) then 68130×18⅔= 1271760, which divided by 2520, will give 504 *F.e.* 2 *q.*= *Answer.*

(24.) Stated thus, if 68130*d.* : 1514 *q.* (=504 *F.e.* 2 *q.*) :: 2520*d.* then 1514×2520=3815280, which divided by 68130, will give 56 *q.*=14 *yds.*=*Answer.*

(25.) Stated thus, if 1514 *q.* : 56 *q.* :: 68130*d.* then 68130*d.*×56=3815280*d.* which divided by 1514, 12, and 20, will give 10*l.* 10*s.*=*Answer.*

(26.) Stated thus, if (48 *oz.*=) 3*lb.* : 260*d.* (=1*l.* 1*s.* 8*d.*) :: 468 *oz.* (=29 *lb.* 4 *oz.*) then 468 × 260*d.* which being divided by 48, 12, and 20, will give 10*l.* 11*s.* 3*d.* =*Answer.*

(27.) Stated thus, if 468 *oz.* : 2535*d.* (=10*l.* 11*s.* 3*d.*) :: 48 *oz.* then 2535×48=121680*d.* which being divided by 468, 12, and 20, will give 1*l.* 1*s.* 8*d.*=*Answer.*

(28.) Stated thus, if (6 *quarter oz.*=) 1½ *oz.* : 25 *q.* (=6¼*d.*) :: (13 *quarter oz.*=) 3¼ *oz.* then 25×13=325 *q.* which being divided by 6, 4, and 12, will give 1*s.* 1½*d.*-1. =*Answer.*

(29.) Stated thus, if (7 *q.*=) 1 *E. e.* 2*q.* : 55*d.*::158 *q.* (=39½ *yds.*) then 158×55=8690*d.* which being divided by 7, 12, and 20, will give 5*l.* 3*s.* 5¼*d.*-5.=*Answer.*

(30.) Stated thus, if (480 *grs.*=) 1 *oz.* : 1250*d.* (=5*l.* 4*s.* 2*d.*) :: 1 *gr.* then 1250÷480=2½*d.*-200.=*Answer.*

(31.) Stated thus, if 14 *yds.* : 192*s.* (=9*l.* 12*s.*) :: 75 *yds.* then 192 × 75=14400*s.* which being divided by 14 and 20, will give 51*l.* 8*s.* 6¾*d.*-6.=*Answer.*

(32.) Stated thus, if 1350*d.* (=5*l.* 12*s.* 6*d.*) : 108 *q.* (=27 *yds.*) :: 24000*d.* (=100*l.*) then 24000 × 108=2592000, which being divided by 1350 and 5, will give 384 *E. e.*=*Answer.*

(33.) Stated thus, if 112 *lb.* : 3030*d.* :: 1615 *lb.* (=14 *cwt.* 1 *q.* 19 *lb.*) then 3030 × 1615=4893450*d.* which being divided by 112, 12, and 20, will give 182*l.* 0*s.* 11½*d.*-8=*Answer.*

(34.) Stated thus, if 7 *yds.* : 212*d.* (=17*s.* 8*d.*) :: 137½ *yds.* (=27½ × 5,) then 137½ × 212=29150*d.* which being divided by 7, 12, and 20, will give 17*l.* 7*s.* 0¼*d.*-1.=*Answer.*

(35.) Stated thus, if 3624 *grs.* (=7 *oz.* 11 *dwts.*) : 35*l.* :: 85264 *grs.* (=14 *lb.* 9 *oz.* 12 *dwts.* 16 *grs.*) then 85264 × 35=2984240, which being divided by 3624, will give 823*l.* 9*s.* 3¾*d.*-552.=*Answer.*

(36.) Stated thus, if 5 *q.* : 178¾*d.* (=14*s.* 10¾*d.*) :: 1680 *q.* (=420 *yds.*) then 1680 × 178¾=300300*d.* which being divided by 5, 12, and 20, will give 250*l.* 5*s.*=*Answer.*

(37.) Stated thus, if 3428 *dwts.* (=14 *lb.* 3 *oz.* 8 *dwts.*) : 10284*s.*=514*l.* 4*s.* :: 20 *dwts.* then 10284 × 20=205680*s.* which being divided by 3428 and 20, will give 3*l.*=*Answer.*

(38.) Stated thus, if 4 *q.* : 582*d.* (=2*l.* 8*s.* 6*d.*) :: 106 *q.* (=6 *cwt.* 2 *q.* 14 *lb.* × 4=26 *cwt.* 2 *q.*) then 582 × 106=61692*d.* which being divided by 4, 12, and 20, will give 64*l.* 5*s.* 3*d.*=*Answer.*

(39.) Stated thus, if 6 *yds.* : 96*s.* (=4*l.* 16*s.*) :: 8320 *yds.* (=8 × 4 × 10 × 26) then 8320 × 96=798720*s.* which being divided by 6 and 20, will give 6656*l.*=*Answer.*

(40.) Stated thus, if 24 *lb.* : 6*s.* 6*d.* :: 1836 *lb.* (=3 *q.* 18 *lb.* × 18=16 *cwt.* 1 *q.* 16 *lb.*) then 1836 × 6½=11934*s.* which being divided by 24 and 20, will give 24*l.* 17*s.* 3*d.* =*Answer.*

(41.) Stated thus, if 20 *dwts.* : 5*s.* :: 25060 *dwts.* (=7 *lb.* 5 *oz.* 10 *dwts.* × 14) then 25060 × 5=125300*s.* which being divided by 20 and 20, will give 313*l.* 5*s.*=*Answer.*

(42.) Stated thus, if 14 *lb.* : 102*d.* (8*s.* 6*d.*) :: 271 *lb.* (=2 *cwt.* 1 *q.* 19 *lb.*) then 271 × 102=27642*d.* which being divided by 14, 12, and 20, will give 8*l.* 4*s.* 6¼*d.*-10=*Answer.*

(43.) Stated thus, if 112 *lb* : 688*d.* (=2*l.* 17*s.* 4*d.*) :: 6688 *lb.* (=59 *cwt.* 2 *q.* 24 *lb.*) then 6688 × 688=4601344*d.* which being divided by 112, 12, and 20, will give 171*l.* 3*s.* 7¼.-80.=*Answer.*

(44.) Stated thus, if 1 *a.* : 547 *a.* :: 15*s.* 6*d.* then 547 × 15½=8478*s.* 6*d.* which being divided by 20 and 2, will give 211*l.* 19*s.* 3*d.* the half-year's rent required.

	tons	£	£	*s.*
(45.) First	171 ×	14=	2394	0
Charges add			4	10
Sum=			2398	10 value of the lead.

Stated thus, if 383040 *lb.* (=171 *tons.*) : 575640*d.* (= 2398*l.* 10*s.*) :: 1 *lb.* then 575640 ÷ 383040=1½*d.*-4320. =*Answer.*

(46.) Stated thus, if 40*d.* : 1*p.* :: 10380*d.* (=43*l.* 5*s.*) then 10380*d.* being divided by 40 and 12, will give 21 *doz.* 7½*p.*=*Answer.*

(47.) Stated thus, if 3 *lb.* : 17*d.* :: 329 *lb.* (=27 *doz.* 5 *lb.*) then 329 × 17 (5593*d.*,) which being divided by 3, 12, and 20, will give 7*l.* 15*s.* 4¼*d.*-1.=*Answer.*

(48.) First, 3 *lb.* 7*oz.*, 14 *dwts.* 21 *grs.* = 20997 *grs.*
Which multiply by............ 7
Gives the weight of the 7 ingots, 146979 *grs.*

Then state it thus, if 480 *grs.* : 70*s.* (=3*l.* 10*s.*) :: 146979 *grs.* then 146979 × 70=10288530*s.* which being divided by 480 and 20, will 1071*l.* 14*s.* 5¼*d.*=*Answer.*

(49.) First 9½*d.* × 11=104½*d.* what they stand him in *per day;* then state it thus, if 1*d.* : 104½*d.* :: 365*d.* then 365 × 104½*d.*=38142½ which being divided by 12 and 20, will give 158*l.* 18*s.* 6½*d* =*Answer.*

(50.) Stated thus, if 58*d.* (=4*s.* 10*d.*) : 1 *yd.* :: 124312*d.* (=517*l.* 19*s.* 4*d.*,) then 124312*d.* being divided by 58, will give 2143 *yds.* 1 *q.*-14; again 2143 *yds.* 1 *q.*-14÷86=24 *yds.* 3 *q.* 2 *n.*-64=19 *ells*, 4 *q.* 2 *n.* in a piece, and 64 *rem.*

£ £ s.
(51.) First 200 guineas=210 Then from 896 17
40 half sov= 20 take 230 0
Sum=£230 leaves £666 17=
what he has to spend per year. Stated thus, if 365 *days*. : 666*l*. 17*s*. :: 1*d*. then 666*l*. 17*s*. being divided by 365, will give 1*l*. 16*s*. 6¼*d*.-331.=*Answer*.

RULE OF THREE INVERSE.

(2.) As 90 : 54 :: 50
90
5,0)486,0
97⅕ *men*.

(3.) Stated thus, if 24*d*. : 8 *oz*. :: 18*d*. then 24×8=192 *oz*. which being divided by 18, will give 10 *oz*. 10⅔ *dr*. =*Answer*.

(4.) Stated thus, if 12*s*. : 240 *p*. :: 20*s*. then 240×12 =2880, which being divided by 20, will give 144 pieces.= *Answer*.

(5.) Stated thus, if 5 *q*. : 30 *yds*. :: 3 *q*. then 30×5= 150, which being divided by 3, will give 50 *yds*.=*Answer*.

(6.) Stated thus, if 200*l*. : 12 *m*. :: 150*l*. then 200× 12=2400, which being divided by 150, will give 16 *months*. =*Answer*.

(7.) Stated thus, if 36 *miles* : 1200 *lb*. :: 24 *m*. then 1200×36=43200, which being divided by 24, will give 1800 *lb*.=*Answer*.

(8.) Stated thus, if 12 *d*. : 100 *w*. *men* :: 3 *d*. then 100 ×12=1200, which being divided by 3, will give 400 *workmen*.=*Answer*.

(9.) Stated thus, if 3 *m*. : 1000 *sold*. :: 6 *m*. then 1000×3=3000, which being divided by 6, will give 500 *soldiers*, and as 3 is just equivalent to half of 6, it must of consequence be=*Answer*.

(10.) Stated thus, if 30*l*. : 100 *m*. :: 24*l*. then 100× 30=3000, which being divided by 24, will give 125 *men*. =*Answer*.

(11.) Stated thus, if 12 *h.* : 24 *d.* :: 16 *h.* then 24 × 12 =288, which being divided by 16, will give 18 *days.*=*Ans.*

(12.) Stated thus, if 7 *q.* : 4 *yds*, :: 3 *q.* then 4 × 7= 28, which being divided by 3, will give 9⅓ *yds.*=*Answer.*

(13.) Stated thus, if 14 *m.* : 18 *d.* : : 34 *m.* then 14 × 18=252, which being divided by 34, will give 7 *d.* 9 *h.* 52 *m.*-32=*Answer.*

(14,) Stated thus, if 8 *m.* : 64*l.* :: 12 *m.* then 64 × 8= 512*l.* which being divided by 12, will give 42*l.* 13*s.* 4*d.*= *Answer.*

(15.) Stated thus, if 5 *q.* : 2½ *yds.* : : 3 *q.* then 2½ × 4 × 5=50, which being divided by 3, will give 16⅔*q.* whence 1000 × 16⅔=16666⅔ *q.*=4166 *yds.* 2 *q.* 2 *n.*-2.=*Answer.*

THE DOUBLE RULE OF THREE.

$$\begin{array}{lccccc} (4.) & £ & & m. & & £ \\ & 100 & : & 12 & : & 6 \\ & 75 & : & 9 & & \end{array}$$

Or thus, by Rule II.

$$\left.\begin{array}{r} £100 \\ 12\ m. \end{array}\right\} : \left.\begin{array}{r} £75' \\ 9\ m. \end{array}\right\} :: \begin{array}{c} £ \\ 6 \end{array}$$

$$\frac{\cancel{6}\times9\times\overset{\overset{3}{\cancel{15}}}{\cancel{75}}}{\underset{\underset{4}{\cancel{20}}}{\cancel{100}}\times\underset{\cancel{2}}{\cancel{12}}} = \frac{27}{8} = £3\ 7s.\ 6d. = Ans$$

Assuming as an *Axiom*, that *Effects* have the same *relation* or *ratio* to each other as the *Causes* which produce them under the same circumstances, it is evident that in any two cases of the same kind, we shall have the following proportion :

First Cause : Second Cause :: First Effect : Second Effect; and then, by multiplying the means and the extremes, we shall be enabled to find any *one* term, if the *three* others be supposed to be given.

To avoid the trouble of writing the name of the *required* term or quantity at length, we may denote it by the simple symbol *x*, which must be treated in the same way as any other number; and it may occupy any place in the proportion either by ***itself***, or as a factor, either ***integral*** or ***fractional***, of given numbers; therefore in the above example we shall have

$$100\times 12 : 75\times 9 :: 6 : x.$$

$$\text{whence, } 100\times 12\times x = 75\times 9\times 6.$$

$$\text{and } x = \frac{75\times 9\times 6}{103\times 12} = £3\ \ 7s.\ \ 6d. = \mathit{Ans.}$$

(5.) $\left.\begin{array}{l} 336\,lb.\ (=3\,cwt.) : 882\,lb,\ (7\,cwt.\ 3\,qr.\ 14\,lb.) \\ 150\ miles : 50\ miles. \end{array}\right\} :: 42s.$

$$\frac{\overset{\overset{147}{\cancel{294}}}{\cancel{882}}\times\cancel{50}\times\cancel{42}}{\underset{\underset{4}{\cancel{8}}}{\cancel{336}}\times\underset{\cancel{3}}{\cancel{150}}} = \frac{147}{4} = 36s.\ 9d. = \mathit{Ans.}$$

Or thus by the Rule given above,

$$336\times 150 : 882\times 50 :: 42 : x.$$

$$\text{therefore, } 336\times 150\times x = 882\times 50\times 42,$$

$$\text{and } x = \frac{882\times 50\times 42}{336\times 150} = £1\ \ 16s.\ \ 9d. = \mathit{Answer.}$$

(6.) $\left.\begin{array}{l} 136\ men : 11232\ men \\ 108\ days : \quad 56\ days \end{array}\right\} :: 351\ quarters.$

$$\text{Then } \frac{\overset{104}{\cancel{11232}}\times\overset{7}{\cancel{56}}\times 351}{\underset{17}{\cancel{136}}\times\cancel{108}} = \frac{255528}{17}\,qr. = 15031\tfrac{1}{17}\,qrs.,$$

Or, without abbreviation $=15031$ *qrs.* 864 *rem.=Answer.*

By the foregoing Rule we have the following proportion :—

$$136\times 108 : 11232\times 56 :: 351 : x.$$

$$\text{whence, } x = \frac{11232\times 56\times 351}{136\times 108} = 15031\ qrs.\ \ 864\ rem. = A.$$

7.) $\left.\begin{matrix}8 \textit{ men} : 24 \textit{ men} \\ 7 \textit{ days} : 28 \textit{ days}\end{matrix}\right\} :: 40$ *acres.*

Then $\frac{\overset{3}{\cancel{24}}\times\overset{4}{\cancel{28}}\times 40}{\cancel{8}\times\cancel{7}}=480$ *acres.=Ans.*

Or thus,

$8\times7 : 24\times28 :: 40 : x,$

therefore, $8\times7\times x=24\times28\times40,$

whence, $x=\frac{24\times28\times40}{8\times7}=480$ *acres.=Ans.*

(8.) $\left.\begin{matrix}8 \textit{ men} : 32 \textit{ men} \\ 5 \textit{ days} : 24 \textit{ days}\end{matrix}\right\} :: 40s.$

Then $\frac{32\times\overset{3}{\cancel{24}}\times\overset{8}{\cancel{40}}}{\cancel{8}\times\cancel{5}}=768s.=£38\ 8s.$=*Ans.*

Or thus,

$8\times5 : 32\times24 :: 40 : x,$

whence, $8\times5\times x=32\times24\times40,$

and $x=\frac{32\times24\times40}{8\times5}=768s.=£38\ 8s.$=*Ans.*

(9.) $\left.\begin{matrix}9 \textit{ months} : 12 \textit{ months} \\ 6l. : 3\frac{3}{8}l.\end{matrix}\right\} :: 100l.$

Then $\frac{12\times3\frac{3}{8}\times100}{9\times6}=2\times\frac{3}{8}\times100=\frac{600}{8}l.=75l.$=*Ans.*

Or thus,

$100\times12 : x\times9 :: 6 : 3\frac{3}{8}$

whence $x\times9\times6=100\times12\times3\frac{3}{8},$

$\therefore x=\frac{100\times12\times3\frac{3}{8}}{9\times6}=£75.$=*Ans.*

(10.) $\left.\begin{matrix}351 \textit{ quarters} : 1404 \textit{ quarters.} \\ 56 \textit{ days} : 168 \textit{ days.}\end{matrix}\right\} :: 939$ *soldiers.*

Then $\frac{\overset{4}{\cancel{1404}}\times\overset{3}{\cancel{168}}\times939}{\cancel{351}\times\cancel{56}}=4\times3\times939=11268$ *soldiers.=Ans.*

Or thus,

$939\times168 : x\times56 : 351 : 1404,$

therefore, $x\times56\times351=939\times168\times1404,$

and $x=\frac{939\times168\times1404}{56\times351}=11268$ *soldiers.=Ans.*

(11.) $$\left.\begin{array}{lcl} 7 \textit{ persons} & : & 14 \textit{ persons} \\ 12 \textit{ days} & : & 8 \textit{ days} \end{array}\right\} :: 36 \textit{ gal.} (=2 \textbf{\textit{ kild.}})$$

$$\text{Then } \frac{\overset{2}{\cancel{14}}\times 8\times\overset{3}{\cancel{36}}}{\cancel{7}\ \ \cancel{12}}=18 \textit{ gal}=2\textbf{\textit{ kild.}}\ 12 \textit{ gul.}=\textbf{\textit{Ans.}}$$

Or thus,

$$7\times 12 : 14\times 8 :: 36 : x,$$

$$\therefore\ x=\frac{14\times 8\times 36}{7\times 12}=48 \textit{ gal.}=2\textbf{\textit{ kild.}}\ 12\textit{ g.}=\textbf{\textit{Ans.}}\text{ as before.}$$

(12.) $$\left.\begin{array}{lcl} 14l\ 10s.\ (=3480d.) & : & 5l\ 8s.\ 9d.\ (=1305d.) \\ 30 \textit{ miles} & : & 20 \textit{ miles} \end{array}\right\} :: 60 \textit{ cwt.}$$

$$\text{Then } \frac{\overset{435}{\cancel{1305}}\times\cancel{20}\times\overset{2}{\cancel{60}}}{\underset{\underset{\underset{29}{\cancel{87}}}{\cancel{174}}}{\cancel{3480}}\ \ \cancel{30}}=15 \textit{ cwt.}=\textbf{\textit{Ans.}}$$

Or thus,

$$60\times 20 : x\times 30 :: 3480 : 1305,$$

$$\therefore\ x=\frac{60\times 20\times 1305}{30\times 3480}=15 \textit{ cwt.}=\textbf{\textit{Ans.}}$$

(13.) $$\left.\begin{array}{lcl} 1 \textit{ qr.} (=8 \textit{ bush.}) & : & 3000 \textit{ qrs.} \\ 24 \textit{ days} & : & 16 \textit{ days.} \end{array}\right\} :: 2 \textbf{\textit{ horses}},$$

$$\text{Then } \frac{\overset{1000}{\cancel{3000}}\times\overset{2}{\cancel{16}}\times\cancel{2}}{1\times\underset{\cancel{8}}{\cancel{24}}}=4000 \textit{ horses.}=\textbf{\textit{Answer.}}$$

Or thus,

$$2\times 16 : x\times 24 :: \overset{qr.}{1} : \overset{qrs.}{3000},$$

$$\therefore\ x=\frac{3000\times 2\times 16}{1\times 24}=4000 \textit{ horses.}=\textbf{\textit{Answer.}}$$

(14.) $$\pounds 100 : \pounds 571 :: \pounds 7,$$

$$\overset{yr.}{1} : \overset{yrs.}{6} :: +$$

$$\text{Then } \frac{571\times 7\times\cancel{6}}{\underset{50}{\cancel{100}}\times 1}=\frac{11991}{50}=\pounds 239\ \ 16s.\ \ 4\tfrac{3}{4}d.\ \tfrac{1}{5}.=\textbf{\textit{Ans.}}$$

Or thus,

$$\begin{array}{ccccc} \pounds & yr. & \pounds & yrs. & \pounds \\ 100\times1 & : & 571\times6 & :: & 7 : x, \end{array}$$

Hence $100\times1\times x=571\times6\times7$,

and $x=\dfrac{571\times6\times7}{100\times1}=$ £239 16*s.* 4¾*d.* 20 *rem.*=*Answer.*

$$(15.)\quad \left.\begin{array}{lcl} 2\ tons & : & 12\ tons\ 17\ cwt. \\ 6\ miles & : & 17\ miles \end{array}\right\} :: 10s.$$

Then $\dfrac{12\frac{17}{20}\times17\times\overset{5}{\cancel{10}}}{\cancel{2}\times6}=2\frac{17}{120}\times17\times5=\dfrac{257\times17\times\cancel{5}}{\underset{24}{\cancel{120}}}=182\frac{1}{24}s.=$
9*l.* 2*s.* 0½*d.*=*Ans.*

Or thus,

$$2\times6 : 12\tfrac{17}{20}\times17 :: 10s. : x,$$

$\therefore\ x=\dfrac{12\frac{17}{20}\times17\times\overset{5}{\cancel{10}}}{\cancel{2}\times6}=2\frac{17}{120}\times17\times5=\dfrac{257\times17\times\cancel{5}}{\underset{24}{\cancel{120}}}=182\frac{1}{24}s.=$
9*l.* 2*s.* 0½*d.*=*Ans.*

$$(16,)\quad \begin{array}{lcl} 15\ in. : 14\ in. & :: & 756\ br. \\ 9\ in. : 10\ in. & :: & + \\ \hline \end{array}$$

Then $\dfrac{\overset{\overset{28}{\cancel{84}}}{\cancel{756}}\times14\times\overset{2}{\cancel{10}}}{\underset{\cancel{3}}{\cancel{15}}\times\cancel{9}}=28\times14\times2=784$ *bricks.*=*Ans.*

In this example, the *entire* causes are *compound* quantities depending on *subordinate* causes, and because the effect is the *same*, and may be represented by 1 or any other symbol, we have

$$756\times14\times10 : x\times15\times9 :: 1 : 1$$

therefore, $x\times15\times9=756\times14\times10$,

and $x=\dfrac{756\times14\times10}{15\times9}=784$ *bricks.*=*Ans.* as before.

PRACTICE.

CASE I.

(2.)
lb.
½*d* | ½ | 7695
| 12 | 3847½
2,0) 32,0 7
£16 0 7½

(3.)
lb.
½*d* | ½ | 5740
| 12 | 2870
2,0) 23,9 2
£11 19 2

(4.)
lb.
½*d* | ½ | 6547
¼ | ½ | 3273½
1636¾
12)4910¼
2,0) 40,9 2
£20 9 2¼

(5.)
lb.
½*d* | ½ | 4573
¼ | ½ | 2286½
1143¼
12)3429¾
2,0) 28,5 9
£14 5 9¾

CASE II.

(3) | 1*d* | 1/12 | 54325
½ | ½ | 4527 1
2263 6½
2,0 |)679,0 7½
£ 339 10 7½

(4) | 1*d* | 1/12 | 6254
½ | ½ | 521 2
¼ | ½ | 260 7
130 3½
2,0 |)91,2 0½
£ 45 12 0½

(5) | 2*d* | 1/6 | 2351
2,0 |)39,1 10
£ 19 11 10

(6) | 2*d* | 1/6 | 7210
¼ | 1/8 | 1201 8
150 2½
2,0 |)135,1 10½
£ 67 11 10½

(7) | 2*d* | 1/6 | 2710
½ | ¼ | 451 8
112 11
2,0 |)56,4 7
£ 28 4 7

(8) | 2*d* | 1/6 | 3250
½ | ¼ | 541 8
¼ | ½ | 135 5
67 8½
2,0 |)74,4 9½
£ 37 4 9½

(9)	3*d*	¼	2715
		2,0	)67,8 9
			£38 18 9

(10)	3*d*	¼	7062
	¼	1/12	1765 0
			147 1½
		2,0	)191,2 7½
			£95 12 7½

(11)	3*d*	¼	2147
	½	1/6	536 9
			89 5½
			) 62,6 2½
		2,0	£31 6 2½

(12)	3*d*	¼	7000
	½	1/6	1750
	¼	½	291 8
			145 10
		2,0	)218,7 6
			£109 7 6

(13)	4*d*	⅓	3257
		2,0	)108,5 8
			£54 5 8

(14)	4*d*	⅓	2056
	¼	1/16	685 4
			42 10
		2,0	)72,8 2
			£36 8 2

(15)	4*d*	⅓	3752
	½	⅛	1250 8
			156 4
		2,0	)140,7 0
			£70 7 0

(16)	4*d*	⅓	2107
	½	⅛	702 4
	¼	½	87 9½
			43 10¾
			)83,4 0¼
			£41 14 0¼

(17)	4*d*	⅓	3210
	1	¼	1070
			267 6
		2,0	)133,7 6
			£66 17 6

(18)	4*d*	⅓	2715
	1	¼	905 8
	¼	¼	226 3
			56 6¾
		2,0	)118,7 9¼
			£59 7 9¾

(19)	4*d*	⅓	3120
	1	¼	1040
	½	½	260
			130
		2,0	)143,0
			£71 10

(20)	4*d*	$\frac{1}{3}$	7521	
	1	$\frac{1}{4}$	2507	
	$\frac{1}{2}$	$\frac{1}{2}$	626	9
	$\frac{1}{4}$	$\frac{1}{2}$	313	4$\frac{1}{2}$
			156	8$\frac{1}{4}$
		2,0	)360,3	9$\frac{3}{4}$
			£180 3	9$\frac{3}{4}$

(21)	6*d*	$\frac{1}{2}$	3271	
		2,0	)163,5	6
			£81 15	6

(22)	6*d*	$\frac{1}{2}$	7914	
	$\frac{1}{4}$	$\frac{1}{24}$	3957	
			164	10$\frac{1}{2}$
			)412,1	10$\frac{1}{2}$
			£206 1	10$\frac{1}{2}$

(23)	6*d*	$\frac{1}{2}$	3250	
	$\frac{1}{2}$	$\frac{1}{12}$	1625	
			135	5
		2,0	)176,0	5
			£ 88 0	5

(24)	6*d*	$\frac{1}{2}$	2708	
	$\frac{1}{2}$	$\frac{1}{12}$	1354	
	$\frac{1}{4}$	$\frac{1}{2}$	112	10
			56	5
		2,0	)152,3	3
			£76 3	3

(25)	6*d*	$\frac{1}{2}$	3271	
	1	$\frac{1}{6}$	1635	6
			272	7
		2,0	)190,8	1
			£95 8	1

(26)	6*d*	$\frac{1}{2}$	3254	
	1	$\frac{1}{6}$	1627	
	$\frac{1}{4}$	$\frac{1}{4}$	271	2
			67	1$\frac{1}{2}$
		2,0	)196,5	11$\frac{1}{2}$
			£98 5	11$\frac{1}{2}$

(27)	6*d*	$\frac{1}{2}$	2701	
	1	$\frac{1}{6}$	1350	6
	$\frac{1}{2}$	$\frac{1}{2}$	225	1
			112	6$\frac{1}{2}$
		2,0	)168,8	1$\frac{1}{2}$
			£84 8	1$\frac{1}{2}$

(28)	6*d*	$\frac{1}{2}$	3714	
	1	$\frac{1}{6}$	1857	
	$\frac{1}{2}$	$\frac{1}{2}$	309	6
	$\frac{1}{4}$	$\frac{1}{2}$	154	9
			77	4$\frac{1}{2}$
		2,0	)239,8	7$\frac{1}{2}$
			£119 18	7$\frac{1}{2}$

(29)	6*d*	$\frac{1}{2}$	2710	
	2	$\frac{1}{3}$	1355	
			451	8
		2,0	)180.6	8
			£90 6	8

(30)	6*d*	$\frac{1}{2}$	3514	
	2	$\frac{1}{3}$	1757	
	$\frac{1}{4}$	$\frac{1}{8}$	585	8
			73	2$\frac{1}{2}$
		2,0	)241,5	10$\frac{1}{2}$
			£120 15	10$\frac{1}{2}$

(31)	6*d*	½	2759	
	2	½	1379	6
	½	⅓	459	10
		¼	114	11½
		2,0	)195,4	3½
			£97 14	3½

(32)	6*d*	½	9872	
	2	½	4936	
	½	⅓	1645	4
	¼	¼	411	4
		½	205	8
		2,0	)719,8	4
			£359 18	4

(33)	6*d*	½	5272	
	3	½	2636	
		½	1318	
		2,0	)395,4	
			£197 14	

(34)	6*d*	½	6325	
	3	½	3162	6
	¼	$\frac{1}{12}$	1581	3
			131	9¼
		2,0	)487,5	6¼
			£243 15	6¼

(35)	6*d*	½	7924	
	3	½	3962	
	½	⅙	1981	
			330	2
		2,0	)627,3	2
			£313 13	2

(36)	6*d*	½	2150	
	3	½	1075	
	½	⅙	537	6
	¼	½	89	7
			44	9½
		2,0	)174,6	10½
			£ 87 6	10½

(37)	6*d*	½	6325	
	3	½	3162	6
	1	⅓	1581	2
			527	1
		2,0	)527,0	10
			£263 10	10

(38)	6*d*	½	5724	
	3	½	2862	
	1	⅓	1431	
	¼	¼	477	
			119	3
		2,0	)488,9	3
			£244 9	3

(39)	6*d*	½	6327	
	3	½	3163	6
	1	⅓	1581	9
	¼	¼	527	3
			131	9¾
		2,0	)540,4	3¾
			£270 4	3¾

(40)	6*d*	½	3254	
	3	½	1627	
	1	⅓	813	6
	½	½	271	2
			135	7
		2,0	)284,7	3
			£142 7	3

(41)	6*d*	½	7291	
	3	½	3645	6
	1	⅓	1822	9
	½	½	607	7
	¼	½	303	9½
			151	10¾
		2,0	)653,1	6¼
			£326 11	6¼

(42)	1*d*	1/12	3256	
		Sub	271	4
		2,0	)298,4	8
			£149 4	8

(43)	6*d*	½	7254	
	3	½	3627	
	2	⅔	1813	6
	¼	⅛	1209	0
			151	1½
		2,0	)680,0	7½
			£340 0	7½

(44)	6*d*	½	3754	
	3	½	1877	
	1	⅓	938	6
	1	⅓	312	10
	½	½	312	10
			156	5
		2,0	)359,7	7
			£179 17	7

(45)	6*d*	½	7972	
	3	½	3986	
	1	⅓	1993	
	1	⅓	664	4
	½	½	664	4
	¼	½	332	2
			166	1
		2,0	)780,5	11
			£390 5	11

CASE III.

(3)	½*d*	1/24	2712	
	¼	½	113	
			56	6
		2,0	)288,1	6
			£114 1	6

(4)	1*d*	1/12	2107	
			175	7
		2,0	)228,2	7
			£114 2	7

(5)	1*d*	1/12	3215	
	¼	¼	267	11
			66	11¾
		2,0	)3549,	10¾
			£177 9	10¾

(6)	1*d*	1/12	2790	
	½	½	232	6
			116	3
		2,0	)313,8	9
			£156 18	9

(7)	1*d*	1/12	7904	
	½	½	658	8
	¼	½	329	4
			164	8
		2,0	)905,6	8
			£452 16	8

(8)	2*d*	⅙	3750	
			625	
		2,0	)437.5	
			£218 15	

(9)	2*d*	⅙	3291	
	¼	⅛	548	6
			68	6¾
		2,0	)390,8	0¾
			£195,8	0¾

(10)	2*d*	⅙	9254	
	½	¼	1542	4
			385	7
		2,0	)1118,1	11
			£559 1	11

(11)	2*d*	⅙	7250	
	½	¼	1208	4
	¼	½	302	1
			151	0½
		2,0	)891,1	5½
			£145 11	5½

(12)	3*d*	¼	7591	
			1897	9
		2,0	)948,8	9
			£474 8	9

(13)	3*d*	¼	6325	
	¼	$\frac{1}{12}$	1581	3
			131	9¼
		2,0	)803,8	0¼
			£401 18	0¼

(14)	3*d*	¼	5271	
	½	⅙	1317	9
			219	7½
		2,0	)680,8	4½
			£340 8	4½

(15)	3*d*	¼	3254	
	½	⅙	813	6
	¼	½	135	7
			67	9½
		2,0	)427,0	10½
			£213 10	10½

(16)	4*d*	⅓	2915	
			971	8
		2,0	)388,6	8
			£194 6	8

(17)	4*d*	⅓	3270	
	¼	$\frac{1}{16}$	1090	
			68	1½
		2,0	)442,8	1½
			£221 8	1½

(18)	4*d*	⅓	7059	
	½	⅛	2353	
			294	1½
		2,0	)970,6	1½
			£485 6	1½

(19)	4*d*	⅓	2750	
	½	⅛	916	8
	¼	½	114	7
			57	3½
		2,0	)383,8	6½
			£191 18	6½

(20)	4*d*	⅓	3725	
	1	¼	1241	8
			310	5
		2,0	)527,7	1
			£263 17	1

(21)	4*d*	⅓	7250	
	1	¼	2416	8
	¼	¼	604	2
			151	0½
		2,0	)1042,1	10½
			£521 1	10½
(22)	4*d*	⅓	2597	
	1	¼	865	8
	½	½	216	5
			108	2½
		2,0	)378,7	3½
			£189,7	3½
(23)	4*d*	⅓	7210	
	1	¼	2403	4
	½	½	600	10
	¼	½	300	5
			150	2½
		2,0	)1066,4	9½
			£533 4	9½
(24)	6*d*	½	7524	
			3762	
		2,0	)1128,6	
			£564	6
(25)	6*d*	½	7103	
	¼	$\frac{1}{24}$	3551	6
			147	11¾
		2,0	)1080,2	5¾
			£540 2	5¾
(26)	6*d*	½	3254	
	½	$\frac{1}{12}$	1627	
			135	7
		2,0	)501,6	7
			£250 16	7

(27)	6*d*	½	7925	
	½	$\frac{1}{12}$	3962	6
	¼	½	330	2½
			165	1¼
		2,0	)1238,2	9¾
			£619 2	9¾
(28)	6*d*	½	9271	
	1	⅙	4635	6
			772	7
		2,0	)1467,9	1
			£733 19	1
(29)	6*d*	½	7210	
	1	⅙	3605	
	¼	¼	600	10
			150	2½
		2,0	)1156,6	0½
			£578 6	0½
(30)	6*d*	½	2310	
	1	⅙	1155	
	½	½	192	6
			96	3
		2,0	)375,3	9
			£187 13	9
(31)	6*d*	½	2504	
	1	⅙	1252	
	½	½	208	8
	¼	½	104	4
			52	2
		2,0	)412,1	2
			£206 1	2
(32)	6*d*	½	1752	
	2	⅓	876	
			292	
		2,0	)292,0	
			£146	0

(33)	6*d*	½	2905	
	2	⅓	1452	6
	¼	⅛	484	2
			60	6¼
		2,0	)490,2	2¼
			£245 2	2¼

(34)	6*d*	½	7104	
	2	⅓	3552	
	½	¼	1184	
			296	
		20	)1213,6	
			£606 16	

(35)	6*d*	½	1004	
	2	⅓	502	
	½	¼	167	4
	¼	½	41	10
			20	11
		2,0	)173,6	1
			£86 16	1

(36)	6*d*	½	2104	
	3	½	1052	
			526	
		2,0	)368,2	
			£184 2	

(37)	6*d*	½	2571	
	3	½	1285	6
	¼	1/12	642	9
			53	6¾
			)455,2	9¾
			£227,12	9¾

(38)	6*d*	½	2104	
	3	½	1052	
	½	⅙	526	
			87	6
			)376,9	8
			£188 9	8

(39)	6*d*	½	7506	
	3	½	3753	
	½	⅙	1876	6
	¼	½	312	9
			156	4½
			)1360,4	7½
			£680 4	7½

(40)	6*d*	½	1071	
	3	½	535	6
	1	⅓	267	9
			89	3
			)196,3	6
			£ 98,3	6

(41)	6*d*	½	5200	
	3	½	2600	
	1	⅓	1300	
	¼	¼	433	4
			108	4
		2,0	)964,1	8
			£482 1	8

(42)	6*d*	½	2117	
	3	½	1058	6
	1	⅓	529	3
	½	½	176	5
			88	2½
		2,0	)396,9	4½
			£198 9	4½

(43)	6*d*	½	1007
	3	½	503 6
	1	⅓	251 9
	½	½	83 11
	¼	½	41 11½
			20 11¾
			)190,9 1¼
			£95 9 1¼

(44)	6*d*	½	5000
	3	½	2500
	2	⅔	1250
			833 4
		2,0	)958,3 4
			£ 479 3 4

(45)	6*d*	½	2105
	3	½	1052 6
	2	⅔	526 3
	¼	⅛	350 10
			43 10¼
			)407,8 5¼
			£203 18 5¼

(46)	6*d*	½	1006
	3	½	503
	2	⅔	251 6
	½	¼	167 8
			41 11
			)197,0 1
			£98 10 1

(47)	6*d*	½	2705
	3	½	1352 6
	2	⅔	676 3
	½	¼	450 10
	¼	½	112 8½
			56 4¼
		2,0	)535,3 7¾
			£267 13 7¾

(48)	6*d*	½	5000
	3	½	2500
	2	⅔	1250
	½	¼	833 4
			208 4
			)979,1 8
			£489 11 8

(49)	6*d*	½	4000
	4	⅓	2000
	1½	¼	1333 4
	¼	⅙	500 0
			83 4
			)791,6 8
			£395 16 8

CASE IV.

2750
1
£275,0

3254
2
£650,8
2
16*s.*

2710
3
£813,0

(4.) 1572
4
£628,8
2
16*s.*

(5.) 2)2102
£1051

(6.) 2101
6
£1260,6
2
12*s.*

(7.) 5271
7
£3689,7
2
14*s*

(8.) 3723
8
£2498,4
2
8*s.*

(9.) 1621
9
£1458,9
2
18*s.*

CASE V.

2,0)270,3
£135 3

4)3271
£817 15

2715
7
2,0)1900,5
£950 5

3214
9
2,0)2892,6
£1446 6

(6.) 2710
11
2,0)2981,0
£1490 10

(7.) 3179
13
2,0)4132,7
£2066 7

(8.) 2150
15
2,0)3225,0
£1612 10

(9.) 3142
17
2,0)5341,4
£2670 14

(10.) 2150
19
2,0)4085,0
£2042 10

(11.) 7157
19
2,0)13598,3
£6799.3

			CASE VI.
(1)	6s. 8d.	⅓	2710
			£903 6 8
(2)	3s. 4d.	1/6	3150
			£525
(3)	2s. 6d.	⅛	2715
			£339 7 6
(4)	1s. 8d.	1/12	7150
			£595 16 8
(5)	1s. 4d.	1/15	3215
			£214 6 8
(6)	1s. 3d.	1/16	7211
			£450 13 9
(8)	6d.	½	7514
			4
			30056
	1	1/6	3757
			626 2
			)3443,9 2
			£1721 19 2
(9)	3d.	¼	2517
			5
			12585
			629 3
		2,0	)1321,4 3
			£660 14 3

(10)	3d	¼	2547
			7
			17829
	½	1/6	636 9
			106 1½
		2,0	)1857,1 10½
			£928 11 10½
(11)	6d	½	3271
			5
			16355
	3	½	1635 6
	½	1/6	817 9
			136 3½
		2,0	)1894,4 6½
			£947 4 6½
(12)	4d	⅓	2103
			15
			31545
	½	⅛	701
			87 7½
		2,0	)3233,3 7½
			£1616 13 7½
(13)	6d	½	7152
			17
			121584
	½	1/12	3576
	¼	½	298
			149
		2,0	)12560,7
			£6280 7

(14)	6*d*	½	2510	
			14	
			35140	
	1	⅙	1255	
	¼	¼	209	2
			52	3½
		2,0	)3665,6	5½
			£1832 16	5½

(15)	4*d*	⅓	3715	
			9	
			33435	
	½	⅛	1238	4
			154	9½
		2,0	)3482,8	1½
			£1741 8	1½

(16)	6*d*	½	2572	
			13	
			33436	
	1	⅙	1286	
	½	½	214	4
			107	2
		2,0	)3504,3	6
			£1752 3	6

17)	6*d*	½	7251	
			14	
			101514	
	2	⅓	3625	6
	¼	⅛	1208	6
			151	0¾
		2,0	)10649,9	0¾
			£5324 19	0¾

(18)	6*d*	½	3210	
			15	
	1	⅙	48150	
	½	½	1605	
	¼	½	267	6
			133	9
			66	10½
(19)		2,0	)5022,3	1½
			£2511 3	1½

	2*d*	⅙	2710	
			19	
			51490	
	½	¼	451	8
			112	11
		2,0	)5205,4	7
			£2602 14	7

(20)	6*d*	½	5746	
			19	
			109174	
	1½	¼	2873	
			718	3
		2,0	)11276,5	3
			£5638,5	3

CASE VII.

(3)	4*s*	⅕	2107	
			2	
			4214	
	4	⅕	421	8
			421	8
			£5056	16

(4)	5s	¼	7156		
			5		
			35780		
	1	⅕	1789		
			357	16	
			£37926	16	

(6)	10*s.*	½	3125		
	5	½	1562	10	
	1	⅕	781	5	
	1	⅕	156	2	
			156	5	
			£5781	5	

(7)	10*s.*	½	2107		
	2	⅕	1053	10	
	1	½	210	14	
			105	7	
			£3476	11	

(8)	6*s.* 8*d.*	⅓	3215		
			4		
			12860		
			1071	13	4
			£13931	13	4

(9)	1*s.*	1/20	2154		
			7		
			15078		
	3*d*	¼	107	14	
			26	18	6
			£15212	12	6

10)	3*s.* 4*d.*	⅙	2701		
			2		
			5402		
			450	3	4
			£5852	3	4

(11)	10*s.*	½	2715		
	5	½	1357	10	
	2	⅖	678	15	
	2*d*	1/12	271	10	
	½	¼	22	12	6
			5	13	1½
			£5051	0	7½

(12)	10*s*:	½	2517		
			3		
			7551		
	5	½	1258	10	
	2*d*	1/30	629	5	
	¼	⅛	20	19	6
			2	12	5¼
			£9462	6	11¼

(13)	10*s.*	½	3210		
	5	½	1605		
	2	⅖	802	10	
	1	½	321	0	
	6*d*	½	160	10	
	½	1/12	80	5	
	¼	½	6	13	9
			3	6	10½
			£6189	5	7½

(14)	4*s.*	⅕	2157		
			2		
			4314		
	2	½	431	8	
	1	½	215	14	
	4*d*	⅓	107	17	
	½	⅛	35	19	
			4	9	10½
			£5109	7	10½

(15)	10*s*	$\frac{1}{2}$	142		
	5	$\frac{1}{2}$	71		
	2*d*	$\frac{1}{30}$	35	10	
	$\frac{1}{2}$	$\frac{1}{4}$	1	3	8
	$\frac{1}{4}$	$\frac{1}{2}$		5	11
				2	11$\frac{1}{2}$
			£250	2	6$\frac{1}{2}$

(16)	10*s*	$\frac{1}{2}$	95		
			15		
			1425		
	2	$\frac{1}{5}$	47	10	
	2	$\frac{1}{5}$	9	10	
	6*d*	$\frac{1}{4}$	9	10	
	1	$\frac{1}{6}$	2	7	6
	$\frac{1}{4}$	$\frac{1}{4}$		7	11
				1	11$\frac{3}{4}$
			£1494	7	4$\frac{3}{4}$

(17	10*s*	$\frac{1}{2}$	37		
	5	$\frac{1}{2}$	18	10	
	2	$\frac{2}{5}$	9	5	
	4*d*	$\frac{1}{6}$	3	14	
	1	$\frac{1}{4}$		12	4
	$\frac{1}{2}$	$\frac{1}{2}$		3	1
	$\frac{1}{4}$	$\frac{1}{2}$		1	6$\frac{1}{2}$
					9$\frac{1}{4}$
			£69	6	8$\frac{3}{4}$

(18)	10*s*	$\frac{1}{2}$	2175		
			2		
			4350		
	5	$\frac{1}{2}$	1087	10	
	4*d*	$\frac{1}{15}$	543	15	
	$\frac{1}{2}$	$\frac{1}{8}$	36	5	
			4	10	7$\frac{1}{2}$
			£6022	0	7$\frac{1}{2}$

(19)	10*s*	$\frac{1}{2}$	2150		
			17		
			36550		
	5	$\frac{1}{2}$	1075		
	1	$\frac{1}{5}$	537	10	
	1*d*	$\frac{1}{12}$	107	10	
	$\frac{1}{2}$	$\frac{1}{2}$	8	19	2
			4	9	7
			£38283	8	9

CASE VIII.

			£	*s.*	*d.*
(2)	1*qr.*	¼	1	4	9
					4×4+1=17
			4	19	0
					4
			19	16	0
			1	4	9
	14*lb.*	½		6	2¼
	2	$\frac{1}{7}$		3	1
	1	½			5¼
					2½
			£21	10	8
(3)	1*qr.*	¼	1	7	8
					12×7+1=85
			16	12	0
					7
			116	4	0
			1	7	8
	4*lb.*	$\frac{1}{7}$		6	11
	4	$\frac{1}{7}$			11¾
	2	½			11¾
					5¾
			£118	1	0¼
(4)	1*qr.*	¼	4	5	8
					12×6=72
			51	8	0
					6
			308	8	0
	14*lb.*	½	1	1	5
	2	$\frac{1}{7}$		10	8½
	2	$\frac{1}{7}$		1	6¼
				1	6¼
			£310	3	2

			£	*s.*	*d.*	
(5)	2*qr.*	½	1	1	4	
					3	×9=27
			3	4	0	
					9	
			28	16	0	
	14*lb.*	¼		10	8	
	1	1/14		2	8	
					2¼	
			£29	9	6¼	
			2	17	9	
(6)	2*qr.*	½			11	×7+1=78
			31	15	3	
					7	
			222	6	9	
			2	17	9	
	1	½	1	8	10½	
	4*lb.*	1/7		14	5¼	
	4	1/7		2	0¾	
	4	1/7		2	0¾	
				2	0¾	
			£227	14	0	
(7)	1*qr.*	¼	2	15	9	
					8	×7=56
			22	6	0	
					7	
			156	2	0	
	14*lb.*	½		13	11¼	
	2	1/7		6	11½	
	1	½			11¾	
					5¾	
			£157	4	4¼	

CASE VIII.

			£	s.	d.	
(2)	1*qr.*	¼	1	4	9	
					4	×4+1=17
			4	19	0	
					4	
			19	16	0	
			1	4	9	
	14*lb.*	½		6	2¼	
	2	$\frac{1}{7}$		3	1	
	1	½			5¼	
					2½	
			£21	10	8	
(3)	1*qr.*	¼	1	7	8	
					12	×7+1=85
			16	12	0	
					7	
			116	4	0	
			1	7	8	
	4*lb.*	$\frac{1}{7}$		6	11	
	4	$\frac{1}{7}$			11¾	
	2	½			11¾	
					5¾	
			£118	1	0¼	
(4)	1*qr.*	¼	4	5	8	
					12	×6=72
			51	8	0	
					6	
			308	8	0	
	14*lb.*	½	1	1	5	
	2	$\frac{1}{7}$		10	8½	
	2	$\frac{1}{7}$		1	6¼	
				1	6¼	
			£310	3	2	

			£	s.	d.
(5)	2*qr.*	½	1	1	4
					3 ×9=27
			3	4	0
					9
			28	16	0
	14*lb.*	¼		10	8
	1	1/14		2	8
					2¼
			£29	9	6¼
			2	17	9
(6)	2*qr.*	½			11 ×7+1=78
			31	15	3
					7
			222	6	9
			2	17	9
	1	½	1	8	10½
	4*lb.*	1/7		14	5¼
	4	1/7		2	0¾
	4	1/7		2	0¾
				2	0¾
			£227	14	0
(7)	1*qr.*	¼	2	15	9
					8 ×7=56
			22	6	0
					7
			156	2	0
	14*lb.*	½		13	11¼
	2	1/7		6	11½
	1	½			11¾
					5¾
			£157	4	4¼

			£	s.	d.
(8)	14*lb.*	⅛	3	17	10
					12×8+1=97
			46	14	0
					8
			373	12	0
			3	17	10
	1	$\frac{1}{14}$		9	8¾
					8¼
			£378	0	3
			4	14	6
(9)	2*qr.*	½			6×6+1=37
			28	7	0
					6
			170	2	0
	8*lb.*	$\frac{1}{7}$	4	14	6
	4	½	2	7	3
	1	¼		6	9
				3	4½
					10
			£177	14	8½
(10)	1*qr.*	¼	3	14	6
					5×3=15
			18	12	6
					3
			55	17	6
	8*lb.*	$\frac{1}{14}$		18	7½
	2	¼		5	3¾
				1	3¾
			£57	2	9

			£	*s.*	*d.*	
(11)	2*qr.*	½	4	15	4	
					4	×4×10+12
			19	1	4	=172
					4	
			76	5	4	
					10	
			762	13	4	
			57	4	0	=12 *cwt.*
	1	½	2	7	8	
	8*lb.*	$\frac{1}{7}$	1	3	10	
	4	½		6	9½	
				3	4¾	
			£823	19	0¼	

			£	*s.*	*d.*	
(12.)	14*lb.*	⅛	3	11	6	
					10	×5+3=53
			35	15	0	
					5	
			178	15	0	
			10	14	6	=12 *cwt.*
	2	$\frac{1}{7}$		8	11¼	
	1	½		1	3¼	
					7½	
			£190	0	4	

MENTAL ARITHMETIC.

(1.) 7*s.* 6¾*d.*=90¾*d.* which taken as pounds.=£90 15*s.A.*

(2.) 6*s.* 8*d.*=£⅓. ∴ ⅓ of 99=£33.=*Ans.*

(3.) 1*s.* 8*d.*=£$\frac{1}{12}$. ∴ $\frac{1}{12}$ of 1800=£150.=*Ans.*

(4.) The price taken as shillings=8*s.* 6*d.* which multiplied by 6 (the number of dozens.)=£2 11*s.*=*Ans.*

(5.) 9*s.* 6*d.* × 4=£1 18*s.*=*Ans.*

(6.) 2*s.* 6*d.*=£$\frac{1}{8}$. $\therefore$ $\frac{1}{8}$ of 56=£7.=*Ans.*

(7.) 11*s.* 9*d.* × 3=£1 15*s.* 3*d.*=*Ans,*

(8.) 64*s.*=£3 4*s.* to which add $\frac{1}{8}$=8*s.* and the sum will be £3 12*s.*=*Ans.*

(9.) 1600 *yds.* at £1.=£1600+£200=£1800.=*Ans.*

(10.) 5*s.*=$\frac{1}{4}$. $\therefore$ $\frac{1}{4}$ of 1200=£300.=*Ans.*

(11.) 5*s.* 9$\frac{3}{4}$*d.*=69$\frac{3}{4}$*d.* which taken as pounds.=£69 15*s.*-*A.*

(12.) 2s. 6*d.*=$\frac{1}{8}$. $\therefore$ $\frac{1}{8}$ of 366.=£45 15*s.*=*Aus.*

(13.) 7*s.* 6$\frac{1}{4}$*d.*=90$\frac{1}{4}$*d.* Therefore the cost will be £90. 5*s.*=*Ans.*

(14.) 3*s.* 4*d.*=$\frac{1}{6}$. $\therefore$ $\frac{1}{6}$ of 216=£36.=*Ans.*

(15.) 112*d.*=9*s.* 4*d.* × 3=£1 8*s.*=*Ans.*

(16.) 1*s.* 8*d.*=$\frac{1}{12}$ $\therefore$ $\frac{1}{12}$ of 108=£9.=*Ans.*

(17.) 4*s.* 10$\frac{3}{4}$*d.*=58$\frac{3}{4}$*d.* Therefore the cost will be £58 15*s.*=*Ans.*

(18.) 600 × 3$\frac{1}{3}$=£2000.=*Ans.*

(19.) 5*s.* 6*d.* × 12=£3 6*s.*=*Ans.*

(20.) 9*s.* 6$\frac{3}{4}$*d.*=114$\frac{3}{4}$*d.* which taken as pounds.=£114 15*s.*=*Ans.*

21.) 4*s.*=$\frac{1}{5}$. $\therefore$ $\frac{1}{5}$ of 900.=£180.=*Ans.*

(22.) 48 *cwt.* at £1.=£48. from which deduct 1*s.* (48 farthings.)=£47 19*s.*=*Ans.*

(23.) 8*s.* 10$\frac{3}{4}$*d.*=106$\frac{3}{4}$*d.* Therefore the cost will be £106 15*s.*=*Ans.*

(24.) Here £1 6*s.* 8*d.*=£1$\frac{1}{3}$. $\therefore$ 99 × 1$\frac{1}{3}$=£132.=*Ans.*

TARE AND TRET.

(2.)
qr. lb.
3 19
28
103
241
24823 *gross.*
241 × 10 = 2410 *tare.*
22413 *lbs. neat.*

3.) *lb. cwt. qr. lb.*
100 = 0 3 16
5 × 5 = 25
4 1 24
5
22 1 8 *tare.*

cwt. qr. lb.
163 2 15 *gross.*
22 1 8 *tare.*
141 1 7 *neat.*

(4.) *lb. oz.*
3 5
4 × 4 = 16
13 4
4
53 0 *tare.*

lb. oz.
85 4
4 × 4 = 16
341 0
4
1364 *gross.*
53 *tare*
1311 *lb. neat.* = *Ans.*

(5.) *cwt. qr. lb.*
75 1 14 *gross.*
752 *lb.* = 6 2 24 *tare.*
68 2 18 *neat.*

(6.) 0 2 27
6 × 12 + 3 = 75
4 1 22
12
53 1 12
2 0 25 *top line* × 3.
55 2 9 *gross.*
597 *lb.* = 5 1 9 *tare.*
50 1 0 *neat.*

	cwt.	*qr.*		
(8.)	2	1		
	5×5=25			
	11	1		
		5		
16 *lb.*=$\frac{1}{7}$)	56	1		*gross.*
	8	0	4	*tare.*
	48	0	24	*neat.*

	cwt.	*qr.*	*lb.*	
(9.)	8	3	14	
			9	
16 *lb.*=$\frac{1}{7}$)	79	3	14	*gross.*
	11	1	18	*tare.*
	68	1	24	*neat.*

	cwt.	*qr.*	*lb.*	
(10) 14*lb.*=$\frac{1}{8}$)	84	2	14	*gross.*
	10	2	8¾	*tare.*
	74	0	5¼	*neat.*

	cwt.	*qr.*	*lb.*	
(12.)	7	3	27	*gross.*
		1	8	*tare.*
	7	2	19	*suttle.*
	4			
	30			
	28			
26)	859			
	33	*tret.*		
	826	*lb. neat.*		

	cwt.	*qr.*	*lb.*	
(13) 8*lb.*=$\frac{1}{14}$)	152	1	3	*gross*
2*lb.*=$\frac{1}{4}$)	10	3	14	} *tare.*
	2	2	24	
26)	138	2	21	*suttle.*
	5	1	9	*tret.*
	133	1	12	*neat.*

	cwt.	*qr.*	*lb.*	
(14.)	117	0	21	*gross.*
173*lb.*=	1	2	5	*tare.*
26)	115	2	16	*suttle.*
	4	1	22	*tret.*
	111	0	22	*neat.*

	cwt.	*qr.*	*lb.*	
(16.)	5	2	7	
			7	
8*lb.*=$\frac{1}{14}$)	38	3	21	*gross.*
	2	3	3½	*tare.*
26)	36	0	17½	*tare suttle.*
	1	1	15½	*tret.*
	34	3	2	*tret suttle,*
			22	*cloff.*
	34	2	8	*neat.*

SIMPLE INTEREST.

£
25)268
£ 10 14 4¾. = *A.*

£ s.
25 { 5)945 10
5)189 2
Ans. = £37 16 4¾

£ s.
547 15
3
16,43 5
20
8,65
12
7,80
4
3,20

£ s. *d.*
Then 16 8 7¾
3
£49 5 11¼ = *A.*

(5) £ *s.* *d.*
25 { 5)254 17 6
5) 50 19 6
10 3 10¼ *one year's*
5 *interest.*
£50 19 5¾ = *Ans.*

£ *s.* *d.*
(6.) $\frac{1}{20}$)556 13 4
27 16 8 *one year's*
5 *interest.*
£139 3 4 = *Ans.*

◆

COMMISSION.

£ *s.* *d.*
(8.) 529 18 5
2¼
1059 16 10 = 2
132 9 7¼ = ¼
11,92 6 5¼ sum.
20
18,46
12
5,57
4
2,29
Ans. £11 18 5½.-29

	£	s.	d.	
(9.)	754	16		
		2½		
	1509	12		= 2
	377	8		= ½
	18,87	0 sum.		
	20			
	17,40			
	12			
	4,80			
	4			
	3,20			
Ans.	£18	17	4¾	

	£	s.	d.	
(10.) ½=½)	876	5	10	
			3¾	
	2628	17	6	=3
¼=½)	438	2	11	=½
	219	1	5½	=¼
	32,86	1	10½ sum	
	20			
	17,21			
	12			
	2,62			
	4			
	2,50			
Ans.	£32	17	2½	

* * *

PURCHASING OF STOCK.

	£	s.	d.	
13.)	2054	16		
		10¼		
	20548	0		= 10
	513	14		= ¼
	210,61	14 sum.		
	20			
	12,34			
	12			
	4,08			

	£	s.	d.
Then to	2054	16	0
add	210	12	4
gives	£ 2265	8	4 *Ans.*

	£	s.	d.	
(14.)	1797	14		
		4⅜		
	7190	16		= 4
	674	2	9	= ⅜
	78,64	18	9 sum.	
	20			
	12,98			
	12			
	11,85			
	4			
	3,40			

	£	s.	d.
Then to	1797	14	0
add	78	12	11¾
gives	£1876	6	11¾ *Ans.*

	£	s.	d.	
(15.)	2750	17	0	
			2⅝	
	5501	14	0	= 2
	1719	5	7½	= ⅝
	72,20	19	7½	
	20			
	4,19			
	12			
	2,35			
	4			
	1,42			

	£	s.	d.
Then to	2750	17	0
add	72	4	2¼
gives	2823	1	2¼

BROKAGE.

		£	s.	d.
(17.)	First	7,96	14	7
		20		
		19,34		
		12		
		4,15		

	s.		£	s.	d.	
then	5	¼	7	19	4	
	1	⅕	1	19	10	
				7	11½	
			£2	7	9½	*An.*

		£	s.	d.
(18.)	First	71,05	5	10
		20		
		1,05		
		12		
		0,70		
		4		
		2,80		

	s.		£	s.	d.	
then	5	¼	71	1	0½	
	6d	$\frac{1}{10}$	17	15	3	
			1	15	6¼	
			£19	10	9¼	*Ans.*

(19.) First £ 9,75 6 4

20

15,06

12

76

4

3,04

	s.	d.		£	s.	d.
then	5	0	¼	9	15	0¾
	1	0	⅕	2	8	9
		6	½		9	9
					4	10½
				£3	3	4½ *Ans.*

(22.) First £ 325 7 6

6

19,52 5 0

20

10,45

12

5,40

4

1,60

			£	s.	d.
then	½	½	19	10	5¼
					3½
			58	11	3¾
			9	15	2½
			£68	6	6¼ *Ans.*

(23.) First £ 547 2 4

4

21,88 9 4

20

17,69

12

8,32

4

1,28

			£	s.	d.
then	½	½	21	17	8¼
					5½
			109	8	5¼
			10	18	10
			£120	7	3¼ *Ans.*

(24.) First £ 257 5 1

4

10,29 0 4

20

5,80

12

9,64

4

2,56

			£	s.	d.
then	½	½	10	5	9½
	¼	½	5	2	10¾
			2	11	5¼
			£18	0	1½

		£	s.
(25.)	First	479	5
			5
		23,96	5
		20	
		19,25	
		12	
		3,00	

	£	s.	d.	
then | ¼ | ¼ |	23	19	3	
			5¼	
	119	16	3	
	5	19	9¾	
	£125	16	0¾	*Ans.*

		£	s.	d.
(27.)	First	397	9	5
				3½
		1192	8	3
		198	14	8½
		13,91	2	11½
		20		
		18,22		
		12		
		2,75		
		4		
		3,02		

	£	s.	d.	
then | ¼ | ¼ |	13	18	2¾	
			2¼	
	27	16	5½	
	3	9	6½	
	£31	6	0	*Ans.*

		£	s.	d.
(28.)	First	576	2	7
				4½
		2304	10	4
		288	1 ·	3½
		25,92	11	7½
		20		
		18,51		
		12		
		6,19		

	£	s.	d.
then | ¼ | ¼ |	25	18	6
			7¼
	181	9	6
	6	9	7½
	£187	19	1½

		£	*s.*	*d.*
(29.)	First	279	13	8
				5$\frac{1}{2}$
		1398	8	4
		69	18	5
		14,68	6	9
		20		
		13,66		
		12		
		8,01		

	£	*s.*	*d.*	
then	14	13	8	
			3$\frac{1}{2}$	
	44	1	0	
	7	6	10	
	£51	7	10	*Ans.*

When the Interest is required for any number of Weeks.

(31,) As 100*l.* : 259*l.* 13*s.* 5*d.* :: 5*l.* : ***first answer;*** and as 52*w.* : 20*w.* :: ***first answer* : *answer required;*** then $\frac{259l.\ 13s.\ 5d. \times 5 \times 20}{100 \times 52} = \frac{259l.\ 13s.\ 5d.}{52} = 4l.\ 19s.\ 10\frac{1}{4}d. = A$

(32.) As 100*l.*:375*l.* 6*s.* 1*d.* :: 4$\frac{1}{2}$*l.* : ***first answer;*** and as 52*w.* : 12*w.* :: ***first answer* : *sccond answer;*** then $\frac{375l.\ 6s.\ 1d. \times 4\frac{1}{2} \times 12}{100 \times 52} = 3l.\ 17s.\ 11\frac{1}{4}d.$ the interest, and 375*l.* 6*s.* 1*d.*+3*l.* 17*s.* 11$\frac{1}{4}$*d.*=379*l.* 4*s.* 0$\frac{1}{4}$*d.* the amount=*A*

(33.) As 100*l.* : 256*l.* 5*s.* 3*d.* :: 2$\frac{3}{4}$*l.* : ***first answer;*** and as 52*w.* : 25*w.* :: ***first answer* : *second answer;*** then $\frac{256l.\ 5s.\ 3d. \times 2\frac{3}{4} \times 25}{100 \times 52} = 3l.\ 7s.\ 9d.$ the interest; and 256*l.* 5*s.* 3*d.*+3*l.* 7*s.* 9*d.*=259*l.* 13*s.* the amount.=***Ans.***

When the Interest is for any number of Days.

		£	*s.*	*d.*	
(35.)	First	20)379	5	4	
		18	19	3	the interest for one year.
				3	
		56	17	9	ditto, for three years.

Again, as 365 *da.* : 18*l.* 19*s.* 3*d.* :: 75 *da.* then $\frac{18l.\ 19s.\ 3d. \times 75}{365} = 3l.\ 17s.\ 11d.$ whence 56*l.* 17*s.* 9*d.*+3*l.* 17*s.* 11*d.*=60*l.* 15*s.* 8*d.*=*Ans.*

(36.) First $\frac{985l.\ 2s.\ 7d. \times 5\frac{1}{2}}{100}=54l.\ 3s.\ 7\frac{1}{2}d.\text{-}82$, the interest for a year, which × *by* 5. gives 270*l.* 18*s.* 2½*d.* the interest for 5 years; then as 365 *da.* : 54*l.* 3*s.* 7½*d.* :: 127 *da.* : $\frac{54l.\ 3s.\ 7\frac{1}{2}d. \times 127.}{365}=18l.\ 17s.\ 0\frac{1}{2}d.$ and 270*l.* 18s. 2½*d.*+18*l.* 17*s.* 0½*d.*=289*l.* 15*s.* 3*d.*=*Ans.*

(37.) $\frac{\text{First } 2726l.\ 1s.\ 4d. \times 4\frac{1}{2}}{100}=122l.\ 13s.\ 5\frac{1}{2}d.$ which ×*by* 3, gives 368*l.* 0*s.* 4½*d.* the interest for 3 years; then as 365 *da.* : 122*l.* 13*s.* 5½*d.*::154*da.* : $\frac{122l.\ 13s.\ 5\frac{1}{2}d \times 154}{365}$ =51*l.* 15*s.* 1¾*d.* and 368*l.* 0*s.* 4½*d.*+51*l.* 15*s.* 1¾*d.*=419*l.* 15*s.* 6¼*d.*=*Ans.*

When the amount, time, and rate per cent. are given, to find the principal.

(39.) First 4×9+100=136*l.* the amount of 100*l.* for the given time; then as 136*l.* : 100*l.* ::734*l.* 8*s.* : $\frac{734l.\ 8s. \times 100}{136}$ =540*l.*=*Ans.*

(40.) First 5×7+100=135*l.* the amount of 100*l.* for the given time; then, as 135*l.* : 100*l.*::334*l.* 16*s.* : $\frac{334l.\ 16s. \times 100}{135}=248l.$=*Ans.*

When the principal, rate per cent., and amount are given, to find the time.

(42.) First as 100*l.* : 4*l.* :: 540*l.* : 21*l.* 12*s.* interest of the principal for one year; then as 21*l.* 12*s.* : 1 *yr.*:: 194*l.* 8*s.* : 9 *yrs.*=*Ans.*

$$\begin{array}{r} \pounds \\ \text{(43.) First } 2{,}0)\underline{24{,}8} \\ \pounds 12\ \ 8 \end{array}$$ interest of the principal for one year; then as 12*l.* 8*s.* : 1 *yr.*::86*l.* 16*s.* : 7 *yrs.*=*Ans.*

When the principal, amount, and time are given, to find the rate per cent.

(45.) First 334*l.* 16*s.*—248*l.*=86*l.* 16*s.* the interest for the whole time; then as 248*l.* : 86*l.* 16*s.*:: 100*l.* :

$\frac{86l.\ 16s. \times 100}{248}=35l.$; whence 35÷7=5*l. rate per cent.*=*A.*

(46.) First 734*l.* 8*s.*—540*l.*=194*l.* 8*s.* the interest for the whole time; then as 540*l.* : 194*l.* 8*s.* :: 100*l.* : $\frac{194l.\ 8s. \times 100}{540}=36l.$; whence 36÷9=4*l. rate per cent.*=*A.*

COMPOUND INTEREST.

(2.) First 400*l.* ×6=2400*l.* which÷100=24*l.* interest. and added to 400*l.*=424*l.* second year's principal; then 424*l.* ×6=2544*l.* which÷100=25*l.* 8*s.* 9½*d.* interest, and added to 424*l.*=449*l.* 8*s.* 9½*d.* third year's principal; which ×by 6=2696*l.* 12*s.* 9*d.* and÷100=26*l.* 19*s.* 3¾*d.* interest, which added to 449*l* 8*s.* 9½*d.*=476*l.* 8*s.* 1¼*d.* fourth year's principal; which ×by 6=2858*l.* 8*s.* 7½*d.* and divided by 100=28*l.* 11*s.* 8*d.* half of which is=14*l.* 5*s.* 10*d.* interest for half a year; then 476*l.* 8*s.* 1¼*d.*+14*l.* 5*s.* 10*d.*=490*l.* 13*s.* 11¼*d.* the amount=*Ans.*

			£	*s.*	*d.*	
(3.)	5*l.* is	$\frac{1}{20}$	650	0	0	first year's principal.
			32	10	0	.... interest.
		$\frac{1}{20}$	682	10	0	second year's principal.
			34	2	6	.... interest.
		$\frac{1}{20}$	716	12	6	third year's principal.
			35	16	7½	.... interest.
		$\frac{1}{20}$	752	9	1½	fourth year's principal.
			37	12	5¼	.... interest.
		$\frac{1}{20}$	790	1	6¾	fifth year's principal.
			39	10	0¾	.... interest.
			£829	11	7½	the amount=*Ans.*

(4.) First 550*l.* 10*s.*×6=3303*l.* which÷100=33*l.* 0*s.* 7*d.* interest, and added to 550*l.* 10*s.*=583*l.* 10*s.* 7*d.* second year's principal: then 583*l.* 10*s.* 7*d.*×6=3501*l.* 3*s.* 6*d.* which÷100=35*l.* 0*s.* 2¾*d.* interest, and added to 583*l.* 10*s.* 7*d.*=618*l.* 10*s.* 9¾*d.* third year's principal; which ×by 6=

3711*l.* 4*s.* 10½*d.* and÷100=37*l.* 2*s.* 2¾*d.* interest, which added to 618*l.* 10*s.* 9¾*d.*=655*l.* 13*s.* 0½*d.* fourth year's principal; which × by 6 and ÷ 100=39*l.* 6*s.* 9¼*d.* half of which is 19*l.* 13*s.* 4½*d.*; then 655*l.* 13*s.* 0½*d.*+19*l.* 13*s.* 4½*d.* =675*l.* 6*s.* 5*d.* the amount=*Ans.*

(5.) First 764*l.*×6=4584*l.* which÷100=45*l* 16*s.* 9½*d.* interest, and added to 764*l.*=809*l.* 16*s.* 9½*d.* second year's principal; then 809*l.* 16*s.* 9½*d.* ×by 6=4859*l.* 0*s.* 9*d.* and÷100=48*l.* 11*s.* 9½*d.* interest, which added to 809*l* 16*s.* 9½*d.* =858*l.* 8*s.* 7*d.* third year's principal; which ×by 6=5150*l.* 11*s.* 6*d.* and÷100=51*l.* 10*s.* 1¼*d.* interest, which added to 858*l.* 8*s.* 7*d.*=909*l.* 18*s.* 8¼*d.* fourth year's principal; which ×by6=5459*l.* 12*s.* 1½*d.* and÷100=54*l.* 11*s.* 11*d.* interest, which added to 909*l*, 18*s.* 8¼*d.*=964*l.* 10*s.* 7¼*d*, fifth year's principal; which × by 6=5787*l.* 3*s.* 7½*d.* and÷100=57*l.* 17*s.* 5*d.* three-fourths of which is 43*l.* 8*s.* 0¾*d.* interest for 9 months; hence 964*l.* 10*s.* 7¼*d.*+43*l.* 8*s.* 9¾*d.*=1007*l.* 18*s* 8*d.* and 1007*l.* 18*s.* 8*d*,—764*l.* =243*l.* 18*s.* 8*d.* the compound interest=*Ans.*

(6.) 5*l.* is	1/20	57	10	6	first year's principal.
		2	17	6¼	.... interest.
	1/20	60	8	0¼	second year's principal.
		3	0	4¾	.... interest.
	1/20	63	8	5	third year's principal.
		3	3	5	.... interest.
	1/20	66	11	10	fourth year's principal.
		3	6	7	.... interest.
	1/20	69	18	5	fifth year's principal.
		3	9	11	.... interest.
	1/20	73	8	4	amount for five years.

6 *mo.*	½	3	13	5	sixth year's interest.
1	1/6	1	16	8⅓	
14 *days*	½		6	1¼	
1	1/14		3	0½	
				2½	
Sum		2	6	0¾	interest for 7 months, 15 days.
Add		73	8	4	
Sum		75	14	4¾	the whole amount.
		57	10	6	deduct.
		18	3	10¾	the compound interest.=*Ans.*

(7.) First 259*l*. 10*s*. ×4½=1167*l*. 15*s*. which÷100=11*l*. 13*s*. 6½*d*. interest, and added to 259*l*. 10*s*.=271*l*. 3*s*. 6½*d*. second year's principal; then 271*l*. 3*s*. 6½*d*. × by 4½ =1220*l*. 5*s*. 11¼*d*. and ÷ by 100=12*l*. 4*s*. 0½*d*. interest, which added to 271*l*. 3*s*. 6½*d*.=283*l*. 7*s*. 7*d*. third year's principal; which ×by 4½=1275*l*. 4*s*. 1½ *l*. and÷by 100=12*l*. 15*s*. 0¼*d*. interest, which added to 283*l*. 7*s*. 7*d*.=296*l*. 2*s*. 7¼*d*. fourth year's principal; which×by 4½ and÷100 =13*l*. 6*s*. 6*d*. interest for the fourth year; then

		£	*s.*	*d.*	
6 *mo.*	¼	13	6	6	
2	⅓	6	13	3	
1	½	2	4	5	
7 *days*	¼	1	2	2½	
			5	6½	
3 days=			2	4½	
Sum		10	7	9½	interest for 9 months, 10 days.
Add		296	2	7¼	
Sum		306	10	4¾	amount.
Substract		259	10	0	
		47	0	4¾	the compound interest=*Ans.*

DISCOUNT.

(2.) The amount of 100*l*. at the rate per cent. and for the given time, (viz. 9 months,) is readily found to be 103*l*. 15*s*.; then, by the rule, 103*l*. 15*s*. : 100*l*. :: 357*l*. 10*s*. : 344*l*. 11*s*. 6¾*d*. the present worth required.

(3.) The amount of 100*l*. at the rate per cent. and for the given time, (viz. 7 months,) is 102*l*. 18*s*. 4*d*.; then, by the rule, 102*l*. 18*s*. 4*d*. : 2*l*. 18*s*. 4*d*. :: 275*l*. 10*s*. : 7*l*. 16*s*. 1¾*d*. the discount required.

(4.) The amount of 100*l*. at the rate per cent. and for the given time, (viz. 9 months,) is 104*l*. 10*s*.; then, by the rule, 104*l*. 10*s*. : 100*l*. :: 109*l*. 10*s*. : 104*l*. 15*s*. 8¼*d*. the present worth required.

(5.) The amount of 100*l*. at the rate per cent. and for the given time, (viz. 7 months,) is 102*l*. 9*s*. 7*d*.; then by the rule, 102*l*. 9*s*. 7*d*. : 100*l*.::527*l*. 9*s*. 1*d*. : 514*l*. 13*s*. 10½*d*. the present worth required.

(6.) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 66 days,) is 100*l.* 18*s.* 0¾*d.*; then by the rule, 100*l.* 18*s.* 0¾*d.* : 18*s.* 0¾*d.*::85*l.* 10*s.* : 15*s.* 3½*d.* the discount required.

(7.) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 5 months,) is 101*l.* 17*s.* 6*d.*; then, by the rule, 101*l.* 17*s.* 6*d.* : 100*l.* :: 875*l.* 5*s*, 6*d.* : 859*l.* 3*s.* 3¾*d.* + the present worth required.

(8.) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 10 months,) is 104*l.* 3*s.* 4*d.*; then, by the rule, 104*l.* 3*s.* 4*d.* : 100*l.* :: 500*l.* : 480*l.* the present worth required.

(9.) The amount of 100*l.* at the rate per cent. and for the given time, (viz. 15 months,) is 106*l.* 5*s.* : then, by the rule, 106*l.* 5*s.* : 100*l.* :: 75*l.* : 70*l.* 11*s.* 9*d.* the present worth required.

(10.) The amount of 100*l.* at the given rate per cent. for the time of the first payment, (viz. 4 months,) is found to be 101*l.* 13*s.* 4*d.*; then, by the rule, 101*l.* 13*s.* 4*d*, : 100*l.* :: 50*l.* : 49*l.* 3*s.* 7¼*d.* present worth of the first payment.—Again, for the second time of payment, (viz. 8 months,) the amount of 100*l.* will be 103*l.* 6*s.* 8*d.*; then, as '103*l.* 6*s.* 8*d.* : 100*l.* :: 50*l.* : 48*l.* 7*s.* 8¾*d.* present worth of the second payment.—Once more for the third time of payment, (viz. 12 months,) the amount of 100*l.* will be 105*l.*; then 105*l.* : 100*l.* : 50*l.* : 47*l.* 12*s.* 4¼*d.* present worth of the third payment : hence 49*l.* 3*s.* 7¼*d.*+48*l.* 7*s.* 8¾*d.*+47*l.* 12*s.* 4½*d.*=145*l.* 3*s.* 8½*d.* the present worth required.

(11.) First | 3 *mo.* | ¼ | 5
1 5
To which add 100 0 £ *s.* £ *s.* £ *s.* *d.*
Then as 101 5 : 1 5 :: 287 15 : 3 11 0½ } **Discount of first payment**

Again | 6 *mo* | ½ | 5
2 10
Add 100 0 £ *s.* £ *s.* £ *s.* *d.*
Then at 102 10 : 2 10 :: 287 15 : 7 0 4¼ } **Discount of second payment**
Sum £10 11 4¾ **Dis.=An.**

(12.) First | 6 *mo.* | ½ | 4
$\frac{4}{2}$

To which add 100 £ £ £ *s.* *d.*

Then as 102 : 100 :: 200 : 196 1 $6\frac{3}{4}$ Present worth of second payment.

Again, as 104 : 100 :: 200 : 192 6 $1\frac{3}{4}$ Present worth of third payment.

388 7 $8\frac{1}{2}$

Sum 100 0 0 Sum paid down

£488 7 $8\frac{1}{2}$ Pres. worth = *Ans.*

EQUATION OF PAYMENTS.

(2.) £ *m.*
$200 \times 3 = 600$
$100 \times 4 = 400$
$300 \times 5 = 1500$
$200 \times 6 = 1200$
8,00)37,00
4 *mo.* $17\frac{1}{2}$*d. Ans.*

(3.) £ *m.*
$120 \times 2 = 240$
$200 \times 4 = 800$
$40 \times 5 = 200$
36,0)124,0
3*m.* $12\frac{4}{5}$*d. Ans.*

(4.) £ *m.*
$100 \times 3 = 300$
$150 \times 6 = 900$
$250 \times 12 = 3000$
5,00)42,00
8 *m.* $11\frac{1}{5}$*d. Ans.*

(5.) Suppose the debt £8
then 2 *l.* × 2*m.* = 4
1 × 3 = 3
1 × 4 = 4
2 × 5 = 10
1 × 6 = 6
1 × 7 = 7
8)34
$4\frac{1}{4}$ *m. Ans.*

(6.) $60 \times 3 = 180$
$30 \times 6 = 180$
$30 \times 9 = 270$
12,0)63,0
5 *m.* 7*d. Ans.*

NOTE.—This method of finding the equated time is much practised, on account of its easy mode of calculation, yet it is not strictly true, as it neither agrees with the principles of Simple or Compound Interest. However, where the whole time concerned is not long, it will deviate but little from the truth at Simple Interest. The error of this method lies in making no difference between the Interest and the discount, whereas the latter is ever less than the former. The equated time will therefore, by this method, be always something too great.

BARTER.

(3.) First, 4*cwt.* 2*qrs.*=504*lb.* and 504*lb.* ×4=2016*s.* value of the chocolate; whence 2016÷2=224*lb.*=2*cwt.* the quantity of tea.=***Ans.***

(4.) First. 3*l.* 14*s.* ×8=29*l.* 12*s*, price of the cloth, and 1*l.* 1*s.* 6*d.* ×20=21*l.* 10*s.* price of the cheese; whence 29*l.* 12*s.*—21*l.* 10*s.*=8*l.* 2*s.* what B must receive of A in barter.=***Ans.***

(5.) First, 13$\frac{1}{2}$*d.* ×3$\frac{1}{2}$*d*=47$\frac{1}{4}$*d.*=189*qrs.*=the value of the pepper; hence 189÷61=3*lb.* 1$\frac{85}{61}$*oz.* the quantity of ginger.=***Ans.***

(6.) First,

			£	*s.*	*d.*
qrs. 2		$\frac{1}{2}$	1	17	4
					3
lb.			5	12	0
14		$\frac{1}{4}$		18	8
2		$\frac{1}{7}$		4	8
					8
			6	16	0

=1632*d.* value of the tallow; whence 1632÷62=26*doz.* 3$\frac{54}{62}$*lb.* the quantity of candles that must be delivered in barter for the said tallow. =***Ans.***

(7.) First, 608*yds.* ×14*s.*=8512*s.* the value of the cloth; then 8512*s.*—2512*s.* (or 125*l.* 12*s.*)=6000*s.*; again, 85*cwt.* 2*qrs.* 24*lb.*=9600*lb.*; therefore, $\frac{112\times6000}{9600}$=3*l.* 10*s.* the price of B's bee-wax *per cwt.*=***Ans.***

(8.) First, 320 *doz.* × 54*d.*=17280*d.* the value of A's candles, and 30*l.* = 7200*d.*; then 17280*d.*—7200*d.* = 10080*d.* : again, as 8*d.* : 1*lb.* :: 10080*d.* : 1260*lb.*=11 *cwt.* 1*qr.* the quantity of cotton A receives, besides the cash.

(9.) First, 114*lb.* ×6*d.*=684*d.* value of A's tobacco; then as 14*d.* : 1*lb.*::684*d.* : 48$\frac{12}{14}$*lb.* the quantity of cotton B must give to A for his tobacco.

(10.) As 90*d.* : 96*d.* :: 9*d.* : $\frac{96\times9}{90}=\frac{96}{10}=$ 9$\frac{1}{2}$*d.*—$\frac{4}{10}$, how D ought to rate his tobacco in barter, that his profit may be equivalent with C's.

(3.) As 16d. : 20d. :: 100l. : 125l.; then 125l.—100l.=25l. the gain per cent.::*Ans.*

(4.) Here we have as 112l. : 100l.::560l. : 500l. the prime cost.=*Ans.*

(5.) As 13s. 4d. : 16s. :: 100l. : 120l.; then 120l.—100l =20l. the gain per cent.=*Ans.*

(6.) Here we have as 100l. : 115l. :: 27s. 6d. :115l. × $27\frac{1}{2}$÷100=1l. 11s. $7\frac{1}{4}$d.=*Ans.*

(7.) First, as 120l. : 100l. :: 490. : 408l. 6s. 8d. the prime cost of the cloth ; then as 375 yds. : 408l. 6s. 8d.:: 1 yd. : $\frac{408l.\ 6s.\ 8d.}{375}$=1l. 1s. $9\frac{1}{4}$d=*Ans.*

(8.) As 60l. 15s. : 125l. :: 80l. : 164l. 12s. 2d.—$\frac{14}{81}$ from which deduct 100l. and there remains 64l. 12s. 2d the gain per cent.=*Ans.*

(9.) As 100l. : 118l. :: 60l. : $\frac{118\times60}{100}=\frac{118\times6}{10}=$ 70l. 16s. the advanced price of the cambric; then as 450 qrs. (90 ells.) : 70l. 16s.::4 qrs. : $\frac{70l.\ 16s.\times4}{450}$=12s. 7d. =*Ans.*

(10.) As 112l. 10s. : 100l. :: 204l. 15s. : 182l. the prime cost of the lead; then as 195cwt. : 182l. :: 1cwt. : 18s. 8d.=*Ans.*

$$\begin{array}{lrlrrl} & & \textit{yds.}\quad \textit{s.} & \textit{s.} & \textit{d.} & \\ \text{(11.) First,} & & 436\times10\tfrac{1}{3}= & 4505 & 4 & \text{what the cloth sold for} \\ & \text{and} & 436\times\ 8\tfrac{1}{2}= & \underline{3706} & \underline{0} & \text{the price it cost;} \\ & & \text{then the diff.}= & \underline{\underline{799}} & \underline{\underline{4}} & =39l.\ 19s.\ 4d.\ \text{gain of} \\ & & & & & \text{the whole.}=\textit{Ans.} \end{array}$$

(12.) First 69l. × 14=966l. what was paid for the 14 tons of steel, and 2240lb. × 14÷2 × 20=784l. what it was sold for; whence 966l.—784l.=182l. what was lost by the sale.=*Ans.*

(13.) As 100l. : 115l.::32l. : 36l. 16s. the advanced price of the linen; then as 124yds. : 36l. 16s.::1yd. : 5s. 11d.—$\frac{28}{124}$=*Ans.*

(14.) First, $249 \times 4\frac{1}{6} = 1037\ \ 6$ retailing price of the cloth;
and $249 \times 3\frac{1}{3} = \underline{\ 830\ \ 0\ }$ prime cost of ditto.
Diff. $= 207\ \ 6 =$ 10*l.* 7*s.* 6*d.* the profit
= 1*st Ans*,

Again, as 830*s.* : $1037\frac{1}{2}$*s.* :: 100*l.* : 125*l.*; then 125*l.*—100*l.*=25*l.* the gain per cent.=2*nd Ans.*

◆

FELLOWSHIP.

Single Fellowship; or Fellowship without Time.

$$(2.)\ \begin{array}{l} \text{As } 90l. : 180l. :: \\ \text{Or as } 1l. : \ \ 2l. :: \end{array} \left\{\begin{array}{l} 20l. : 40l. = \text{A's} \\ 30l. : 60l. = \text{B's} \\ 40l. : \underline{80l.} = \text{C's} \end{array}\right\} \text{gain.}$$

£180 proof.

$$3.)\ \text{As } 1346l. : 867l. :: \left\{\begin{array}{lrrl} & \pounds & s. & d. \\ 364l. : & 234 & 9 & 3\frac{1}{4}\text{-}70 = \text{A's} \\ 482l. : & 310 & 9 & 5\ \text{-}248 = \text{B's} \\ 500l. : & 322 & 1 & 3\frac{1}{2}\text{-}1028 = \text{C's} \end{array}\right\} \text{gain.}$$

£867 0 0 proof.

$$4.)\ \text{As } 1130l. : 428l. :: \left\{\begin{array}{lrrl} & \pounds & s. & d. \\ 227l. : & 85 & 19 & 6\frac{3}{4}\text{-}690 = \text{B's} \\ 349l. : & 132 & 3 & 9\ \text{-}120 = \text{C's} \\ 115l. : & 43 & 11 & 1\frac{3}{4}\text{-}250 = \text{D's} \\ 439l. : & 166 & 5 & 6\frac{1}{4}\text{-}\ 70 = \text{E's} \end{array}\right\} \text{gain.}$$

£428 0 0 proof.

$$(5.)\ \text{As } 1710l. : 684l. :: \left\{\begin{array}{l} 750l. : 300l. = \text{D's} \\ 600l. : 184l. = \text{E's} \\ 500l. : \underline{200l.} = \text{F's} \end{array}\right\} \text{gain.}$$

£684 proof.

$$\text{(6) As }\overset{\pounds}{836}\ \overset{s.}{7} : \overset{\pounds}{675}\ .\ \overset{s.}{15} :: \left\{\begin{array}{rrcrrl} \pounds & s. & & \pounds & s. & d. \\ 275 & 14 & : & 222 & 15 & 2\ \text{-}6584 \\ 304 & 7 & : & 245 & 18 & 1\tfrac{1}{2}\text{-}15750 \\ 152 & 0 & : & 122 & 16 & 2\tfrac{3}{4}\text{-}12227 \\ 104 & 6 & : & 84 & 5 & 5\ \text{-}15620 \end{array}\right\} =$$

B, C, D, and E's gain.=*Ans.* £675 15 0 proof.

(7.) As the stock is not given, we may suppose it any sum we choose, so that the sum can be exactly divided into the several parts without a remainder; in the present case let it be 60*l.*; then the one-third, one-fourth, one-fifth, and one-sixth thereof, is just 57*l.* whence we have

$$\text{As } 57l : 60l. :: \left\{\begin{array}{rcrrl} & & \pounds & s. & d. \\ 20l. & : & 21 & 1 & 9\tfrac{1}{2}\text{-}\tfrac{10}{19}\text{=A's} \\ 15l. & : & 15 & 15 & 9\tfrac{1}{4}\text{-}\tfrac{17}{19}\text{=B's} \\ 12l. & : & 12 & 12 & 7\tfrac{1}{2}\text{-}\tfrac{6}{19}\text{= C's} \\ 10l. & : & 10 & 10 & 6\tfrac{1}{4}\text{-}\tfrac{5}{19}\text{=D's} \\ & & \pounds 60 & 0 & 0 \end{array}\right\}\text{stock.}$$

$$\begin{array}{r} \text{Again, as } \overset{\pounds}{60} : \overset{\pounds}{100} :: \\ \text{Or as } 3 : 5 :: \end{array} \left\{\begin{array}{rrlcrrl} \pounds & s. & d. & & \pounds & s. & d. \\ 21 & 1 & 0\tfrac{1}{2}\text{-}\tfrac{10}{19} & : & 35 & 1 & 9\ \text{-}48 \\ 15 & 15 & 9\tfrac{1}{4}\text{-}\tfrac{17}{19} & : & 26 & 6 & 3\tfrac{3}{4}\text{-}36 \\ 12 & 12 & 7\tfrac{1}{2}\text{-}\tfrac{6}{19} & : & 21 & 1 & 0\tfrac{1}{2}\text{-}120 \\ 10 & 10 & 6\tfrac{1}{4}\text{-}\tfrac{5}{19} & : & 17 & 10 & 10\tfrac{1}{2}\text{-}24 \end{array}\right\} =$$

A, B, C, and D's gain=*Ans.* £100 0 0 proof.

(8)First then, 1700*l.* × 24=40800*l.* what they sold the estate for.

$$\text{Again, as } 27200l. : 40800l. :: \left\{\begin{array}{rcr} 15000l. & : & 22500l. \\ 12200l. & : & 18300l. \end{array}\right\} =$$

D and E's share.=*Ans.* 40800 proof.

$$\text{(9.) As } 4+6+8=18 : 647l. :: \left\{\begin{array}{rcrrl} & & \pounds & s. & d. \\ 4 & : & 143 & 15 & 6\tfrac{2}{3} \\ 6 & : & 215 & 13 & 4 \\ 8 & : & 287 & 11 & 1\tfrac{1}{3} \end{array}\right\} =$$

D, E, and F's stock.=1*st.* *Ans.* £647 0 0 proof.

$$\begin{array}{l} \\ \text{Again,} \\ \text{as } 647 : 143\ 15\ 6\frac{2}{3} :: \\ \\ \end{array} \left\{ \begin{array}{rrlcrrl} \pounds & s. & d. & & \pounds & s. & d. \\ 143 & 15 & 6\frac{2}{3} & : & 31 & 19 & 0\text{-}207040 \\ 215 & 13 & 4 & : & 47 & 18 & 6\text{-}310560 \\ 287 & 11 & 1\frac{1}{3} & : & 63 & 18 & 0\text{-}414080 \end{array} \right\} =$$

D, E, and F's gain.=*2nd Ans.* $\pounds 143\ 15\ 6\frac{2}{3}$ proof.

DOUBLE FELLOWSHIP; OR, FELLOWSHIP WITH TIME.

Prod.

$$(2.)\ \left. \begin{array}{r} 46968d. \times 2 \\ 43179d. \times 5 \\ 14338d. \times 11 \end{array} \right\} = \left\{ \begin{array}{r} 140904 \\ 215895 \\ 157718 \end{array} \right\} = \left\{ \begin{array}{l} \text{D's} \\ \text{E's} \\ \text{F's} \end{array} \right\} \begin{array}{l} \text{stock in pence} \\ \times \text{into his} \\ \text{time.} \end{array}$$

514517 sum of the products.

$$\text{As } 514517 : 364\ 18 :: \left\{ \begin{array}{rcrrll} 140904 & : & 99 & 18 & 7\frac{1}{4}\text{-} & 75455 \\ 215895 & : & 153 & 2 & 3\frac{1}{2}\text{-} & 28250 \\ 157718 & : & 111 & 17 & 1 & \cdot 410812 \end{array} \right\} = \text{D, E,}$$

(£ s. over 364 18; £ s. d. over the quotients.)

and F's gain.=*Ans.* £364 18 0 proof.

$$(3.)\ \left. \begin{array}{r} 500 \times 5 = 2500 \\ 300 \times 5 = 1500 \\ 600 \times 4 = 2400 \\ 470 \times 4 = 1880 \end{array} \right\} \text{add.} \qquad \left. \begin{array}{r} 400 \times 3 = 1200 \\ 670 \times 6 = 4020 \\ 530 \times 3 = 1590 \\ 630 \times 3 = 1890 \\ 531 \times 3 = 1593 \end{array} \right\} \text{add.}$$

8280 for D. 10293 for E.

$$\left. \begin{array}{r} 900 \times 6 = 5400 \\ 700 \times 5 = 3500 \\ 1200 \times 2 = 2400 \\ 600 \times 5 = 3000 \end{array} \right\} \text{add.}$$

14300 for F.

Then 8280+10293+14300=32873, the sum of the products;

$$\text{therefore as } 32873 : 200l. :: \left\{\begin{array}{rcrrrl} & & \pounds & s. & d. & \\ 8280 & : & 50 & 7 & 6 & \text{-}21720 \\ 10293 & : & 62 & 12 & 5\tfrac{1}{4} & \text{-}29859 \\ 14300 & : & 87 & 0 & 0\tfrac{1}{4} & \text{-}14167 \end{array}\right\} =$$

D, E, and F's gain.=*Ans.* £200 0 0 proof.

$$\begin{array}{c} \textit{Oxen.} \\ (4.)\ \left.\begin{array}{r} 23\times27 \\ 21\times35 \\ 16\times23 \end{array}\right\} \end{array} = \begin{array}{c} \textit{Prod.} \\ \left\{\begin{array}{r} 621 \\ 735 \\ 368 \end{array}\right\} \end{array}$$

the product of each man's oxen × by the days they were feeding.

1724 sum of the products.

$$\text{Then as } 1724 : 8766d. :: \left\{\begin{array}{rcrrrl} & & \pounds & s. & d. & \\ 621 & : & 13 & 3 & 1\tfrac{1}{2} & \text{-}624 = \text{D's} \\ 735 & : & 15 & 11 & 5 & \text{-}1688 = \text{E's} \\ 368 & : & 7 & 15 & 11 & \text{-}1136 = \text{F's} \end{array}\right\} = \text{D,}$$

E, and F's shares.=*Ans.* £36 10 6 proof.

ALLIGATION.

ALLIGATION MEDIAL.

$$\begin{array}{lrlrl} & \textit{Gal.}\ s. & d. & s. & d. \\ (2.) & 15\times8 & 0= & 120 & 0 \text{ value of the canary.} \\ & 20\times7 & 4= & 146 & 8 \text{ ....20 gals. of ditto.} \\ & 10\times6 & 8= & 66 & 8 \text{ ....sherry.} \\ & 24\times4 & 0= & 96 & 0 \text{ ....white wine.} \\ & \underline{69} & &)\underline{429} & \underline{4}(6s.\ 2\tfrac{1}{2}d.\text{-}\tfrac{46}{69} = \textit{Ans.} \end{array}$$

$$\begin{array}{c} \textit{Cwt.}\ s. \\ (3.)\ \left.\begin{array}{r} 4\times56 \\ 7\times43 \\ 5\times37 \end{array}\right\} \end{array} = \begin{array}{c} s. \\ \left\{\begin{array}{r} 224 \\ 301 \\ 185 \end{array}\right\} \end{array} \text{value of the different parcels of sugar.}$$

$$\text{As } \underline{16} : \underline{710} :: 2cwt. : 88s.\ 9d. = 4l.\ 8s.\ 9d = A$$

$$\begin{array}{lrcl} & \textit{Qrs.}\quad \textit{s.} & & \textit{s.}\\ (4.) & \left.\begin{array}{r}30\times28\\46\times30\\24\times25\end{array}\right\} & = & \left\{\begin{array}{l}840 \text{ value of the brown malt.}\\1380\ldots\ldots\ldots\ldots \text{ pale ditto.}\\600\ldots\ldots\ldots\ldots \text{ high-dried ditto.}\end{array}\right.\\ & \overline{100} & &)\overline{2820}(1l.\ 8s.\ 2\tfrac{1}{4}d.\text{-}\tfrac{6}{10}=\textit{Ans.}\end{array}$$

$$\begin{array}{lrcl} & \textit{Bush.}\quad \textit{s.}\quad 6\textit{d.} & & \textit{s.}\quad \textit{d.}\\ (5.) & \left.\begin{array}{rr}27\times5 & 6\\27\times4 & 0\\14\times2 & 8\end{array}\right\} & = & \left\{\begin{array}{rr}148 & 6\\108 & 0\\37 & 4\end{array}\right\}\text{value of the different compounds.}\\ & \overline{68} & &)\overline{294\quad10}(4s.\ 3\tfrac{3}{4}\text{d.}\tfrac{28}{68} \text{ value of a}\end{array}$$

bushel of the mixture.=*Ans.*

$$\begin{array}{lrcl} & \textit{Cwt.}\quad \textit{s.}\quad \textit{d.} & & \textit{s.}\\ (6.) & \left.\begin{array}{rr}3\times56 & 0\\6\times37 & 4\\3\times74 & 8\end{array}\right\} & = & \left\{\begin{array}{r}168\\224\\224\end{array}\right\}\text{value of the parcels of sugar}\\ & \overline{12} & &)\overline{616}(51s.\ 4d.=2l.\ 11s.\ 4d.=\textit{Ans.}\end{array}$$

$$\begin{array}{lrcl} & \textit{Bush.}\quad \textit{s.}\quad \textit{d.} & & \textit{s.}\quad \textit{d.}\\ (7.) & \left.\begin{array}{rr}3\times3 & 5\\4\times5 & 6\\5\times4 & 8\end{array}\right\} & = & \left\{\begin{array}{rr}10 & 3\\22 & 0\\23 & 4\end{array}\right\}\text{value of the mixtures.}\\ & \overline{12} & &)\overline{55\quad7}(4s.\ 7\tfrac{1}{2}d.\tfrac{4}{12}=\textit{Ans.}\end{array}$$

$$\begin{array}{lrcl} & \textit{Gal.}\quad \textit{s.}\quad \textit{d.} & & \textit{s.}\quad \textit{d.}\\ (8.) & \left.\begin{array}{rr}20\times5 & 4\\12\times5 & 0\\30\times6 & 0\\20\times4 & 6\end{array}\right\} & = & \left\{\begin{array}{l}106\quad 8 \text{ value of the Port.}\\60\quad 0\ldots\ldots\ldots\ldots \text{ White wine.}\\180\quad 0\ldots\ldots\ldots\ldots \text{ Lisbon.}\\90\quad 0\ldots\ldots\ldots\ldots \text{ Mountain.}\end{array}\right.\\ & \overline{82} & &)\overline{436\quad8}(5s.\ 3\tfrac{3}{4}d.\tfrac{50}{82}=\textit{Ans.}\end{array}$$

$$\begin{array}{lrcl} & \textit{Bush.}\quad \textit{s.} & & \textit{s.}\\ (9.) & \left.\begin{array}{r}10\times7\\20\times4\\30\times3\end{array}\right\} & = & \left\{\begin{array}{l}70 \text{ value of the wheat.}\\80\ldots\ldots\ldots\ldots \text{ rye.}\\90\ldots\ldots\ldots\ldots \text{ barley.}\end{array}\right.\\ & \overline{60} & &)\overline{240}(4s. \text{ value of a bushel of maslin.}\end{array}$$

(10.) First, 2*s.* 6*d.*+4*s.* 6*d.*=7*s.* then 7s.÷2=3s. 6d.= Ans.

$$(11.)\quad \begin{array}{r} lb.\ \ oz. \\ 12\times6 \\ 8\times7 \\ 10\times8 \\ \hline 30 \end{array}\left.\begin{array}{c} \\ \\ \\ \\ \\ \end{array}\right\} = \left\{\begin{array}{r} oz. \\ 72 \\ 56 \\ 80 \\ \hline)208(\end{array}\right.\text{the different mixtures.}$$

)208(6*oz.* 18*dwts.* 16*gr.* the fineness of 1*lb.* of this composition.=*Ans.*

$$(12.)\quad \begin{array}{r} Bush.\ \ s. \\ 40\times4 \\ 10\times6 \\ 30\times5 \\ 20\times3 \\ \hline \text{As } 100 \end{array}\left.\begin{array}{c} \\ \\ \\ \\ \\ \\ \end{array}\right\} = \left\{\begin{array}{r} s. \\ 160 \\ 60 \\ 150 \\ 66 \\ \hline 430 \end{array}\right\}\text{value of the different mixtures}$$

As 100 : 430 :: 10 *bush.* : 43*s.*=2*l.* 3*s.*=*Ans*

$$(13.)\quad \begin{array}{r} lb.\ \ d. \\ 50\times11 \\ 30\times14 \\ 25\times22 \\ 37\times24 \\ \hline 142 \end{array}\left.\begin{array}{c} \\ \\ \\ \\ \\ \end{array}\right\} = \left\{\begin{array}{r} d. \\ 550 \\ 420 \\ 550 \\ 888 \\ \hline)2408(\end{array}\right\}\text{value of the mixtures.}$$

)2408($16\frac{3}{4}d.\frac{118}{142}$.=*Ans.*

ALLIGATION ALTERNATE.

$$(2.)\quad 8\left\{\begin{array}{l} d. \\ 4 \\ 6 \\ 10 \end{array}\right. \begin{array}{|l} \\ 2 \\ 2 \\ 4+2 \end{array} \begin{array}{|c} lb. \\ 2 \\ 2 \\ 6 \end{array}\Big\}\ \text{the quantity of each sort.}$$

$$(3.)\quad 10\left\{\begin{array}{l} s. \\ 16 \\ 14 \\ 9 \\ 8 \end{array}\right. \begin{array}{|l} d. \\ 1 \\ 2 \\ 6 \\ 4 \end{array}\Big\}\ \text{the quantity of each sort.}=Ans.$$

$$(4.)\quad 30\left\{\begin{array}{l} d. \\ 42 \\ 48 \\ 24 \end{array}\right. \begin{array}{|l} \\ 6 \\ 6 \\ 12+18 \end{array} \begin{array}{|l} bush. \\ 6 \text{ of barley} \\ 6 \text{ of rye} \\ 30 \text{ of oats} \end{array}\Big\}=Ans.$$

(5.)
$$\begin{array}{rllll} & d. & & lb. & \\ 5 & \left\{\begin{array}{l}7\\6\\4\end{array}\right. & \begin{array}{l}1\\1\\2+1\end{array} & \left|\begin{array}{l}1\text{ of raisins of the Sun}\\1\text{ of Malagas}\\3\text{ of Smyrnas}\end{array}\right\} & =\textit{Ans.}\end{array}$$

(6.)
$$\begin{array}{rllll} & d. & & lb. & \\ 20 & \left\{\begin{array}{l}24\\18\\15\end{array}\right. & \begin{array}{l}5+2\\4\\4\end{array} & \left|\begin{array}{r}7\\4\\4\end{array}\right\} & \text{quantity of each sort}=\textit{Ans.}\end{array}$$

ALLIGATION PARTIAL.

(2.)
$$\begin{array}{rlll} & d. & & \\ 32 & \left\{\begin{array}{l}60\\36\\24\\18\end{array}\right. & \left.\begin{array}{r}8\\14\\28\\4\end{array}\right\} & \text{the differences.}\end{array}$$

$$\begin{array}{l}\text{Then as } 8:20::\\ \text{Or, as } 2:\ 5::\end{array}\left\{\begin{array}{rcl}14 & : & 35\text{ bush. of rye}\\ 28 & : & 70\ \ldots\ldots\text{ barley}\\ 4 & : & 10\ \ldots\ldots\text{ oats}\end{array}\right\}\begin{array}{l}\text{to be mixed with}\\ \text{the 20 \textit{bushels} of}\\ \text{wheat.}\end{array}$$

(3.)
$$\begin{array}{rllll} & d. & & & \\ 42 & \left\{\begin{array}{l}48\\36\\24\\18\end{array}\right. & \begin{array}{l}24+18+6\\6\\6\\6\end{array} & \left|\begin{array}{r}48\\6\\6\\6\end{array}\right\} & \begin{array}{l}\text{differences found}\\ \text{as before.}\end{array}\end{array}$$

$$\begin{array}{l} \qquad\quad s. \\ \text{Then as } 6:12::\\ \text{Or, as } 1:\ 2::\end{array}\left\{\begin{array}{rcl}48 & : & 96\text{ bush. of wheat}\\ 6 & : & 12\ \ldots\ldots\text{ rye}\\ 6 & : & 12\ \ldots\ldots\text{ barley}\end{array}\right\}\begin{array}{l}\text{to be mixed with}\\ \text{the 12 \textit{bushels} of}\\ \text{oats.}\end{array}$$

(4.)
$$\begin{array}{rllll} & s. & & & \\ 8 & \left\{\begin{array}{l}12\\7\\4\end{array}\right. & \begin{array}{l}4+1\\4\\4\end{array} & \left|\begin{array}{r}5\\4\\4\end{array}\right\} & \text{differences found as before.}\end{array}$$

$$\begin{array}{l}\text{Then as } 4:40::\\ \text{Or, as } 1:\ 8::\end{array}\left\{\begin{array}{rcl}4 & : & 32\textit{gals.}\text{ of Eng.}\\ 4 & : & 32\ \ldots\text{spirits}\end{array}\right\}\begin{array}{l}\text{to be mixed with 40}\\ \textit{gals.}\text{ French brandy}\end{array}$$

$$\text{(5.)}\qquad 8\left\{\begin{array}{l} \text{s.} \\ 12 \\ 10 \\ 6 \\ 4 \end{array}\right.\qquad \left.\begin{array}{l} \\ 4 \\ 2 \\ 2 \\ 4 \end{array}\right\}$$ the differences found as before.

$$\begin{array}{l} \text{Then as } 4 : 20 :: \\ \text{Or, as } 1 : \ 5 :: \end{array}\left\{\begin{array}{l} 4 : 20 \textit{ lb.} \text{ at } 12\textit{s}, \\ 2 : 10 \ldots\ldots 10\textit{s}. \\ 2 : 10 \ldots\ldots 6\textit{s}. \end{array}\right\}$$ to be mixed with the 20 *lb.* at 4*s.* *per lb*

$$\text{(6.)}\qquad 72\left\{\begin{array}{l} 81 \\ 90 \\ 60 \\ 63 \end{array}\right.\qquad \left.\begin{array}{r} \textit{d.}\ 12 \\ 9 \\ 9 \\ 18 \end{array}\right\}$$ the differences found as before.

$$\begin{array}{l} \text{Then as } 12 : 18 :: \\ \text{Or, as } \ 2 : \ 3 :: \end{array}\left\{\begin{array}{l} 9 : 13\tfrac{1}{2} \textit{ gals.} \text{ of Malaga} \\ 9 : 13\tfrac{1}{2} \ldots\ldots \text{Sherry} \\ 18 : 27 \ldots\ldots \text{White wine} \end{array}\right\}$$ to be mixed with 18 *gals.* of Canary, at 6*s.* 9*d.* *per gallon.*

ALLIGATION TOTAL

$$\text{(2.)}\qquad 7\left\{\begin{array}{l} \text{s.} \\ 5 \\ 6 \\ 8 \\ 9 \end{array}\right.\qquad \left.\begin{array}{l} \\ 1 \\ 2 \\ 2 \\ 1 \end{array}\right\}$$ the differences.

6 the sum of the differences.

$$\text{Then as } 6 : 87 :: \left\{\begin{array}{l} \quad \textit{lb.} \\ 1 : 14\tfrac{1}{2} \\ 2 : 29 \\ 2 : 29 \\ 1 : 14\tfrac{1}{2} \end{array}\right\}$$ the quantity of each sort $=A$.

$$\text{(3.)}\qquad 5\left\{\begin{array}{l} \text{s.} \\ 4 \\ 6 \\ 8 \\ 10 \end{array}\right.\qquad \begin{array}{l} \\ 5+3+1 \\ 1 \\ 1 \\ 1 \end{array}\quad \left|\ \begin{array}{l} \\ 9 \\ 1 \\ 1 \\ 1 \end{array}\right\}$$ the differences found as before.

12 sum of the differences.

$$\begin{array}{l} \text{Then as } 12 : 60 :: \\ \text{Or, as } 1 : 5 :: \end{array} \left\{ \begin{array}{rcr} & & \textit{gals.} \\ 9 & : & 45 \\ 1 & : & 5 \\ 1 & : & 5 \\ 1 & : & 5 \end{array} \right\} \begin{array}{l} \text{the quantity of each sort} = \\ \textit{Ans.} \end{array}$$

(4.)

$$8 \left\{ \begin{array}{r} \textit{d.} \\ 11 \\ 9 \\ 6 \\ 4 \end{array} \right. \begin{array}{r} \textit{s.} \\ 4 \\ 2 \\ 1 \\ 3 \end{array} \left. \vphantom{\begin{array}{r} 4 \\ 2 \\ 1 \\ 3 \end{array}} \right\} \text{the differences found as before.}$$

$$\overline{10} \text{ the sum of the differences.}$$

$$\begin{array}{l} \text{Then as } 10 : 240 :: \\ \text{Or, as } 1 : 24 :: \end{array} \left\{ \begin{array}{rcr} & & \textit{lb.} \\ 4 & : & 96 \\ 2 & : & 48 \\ 1 & : & 24 \\ 3 & : & 72 \end{array} \right\} \begin{array}{l} \text{the quantity of each sort.} = \\ \textit{Ans.} \end{array}$$

(5.)

$$17 \left\{ \begin{array}{r} \textit{carats.} \\ 24 \\ 22 \\ 20 \\ 15 \end{array} \right. \begin{array}{l} \\ 2 \\ 2 \\ 2 \\ 7+5+3 \end{array} \left| \begin{array}{r} \\ 2 \\ 2 \\ 2 \\ 15 \end{array} \right\} \begin{array}{l} \text{the differences} \\ \text{found as before.} \end{array}$$

$$\overline{21} \text{ sum of the differences}$$

Then as 21 : 42, or as 1 : 2 : : 2 : 4 *oz.* the quantity of 24 22, and 20 carats fine, respectively : *Again,* as 1 : 2 : : 15 : 30 *oz.* the quantity of 15 carats fine.

(6.)

$$\begin{array}{c} \textit{s.} \\ 7 \end{array} \left| \begin{array}{c} \textit{s.} \\ 6 \end{array} \right| \left\{ \begin{array}{r} 8 \\ 5 \\ 4 \end{array} \right. \left| \begin{array}{l} 2+1 \\ 2 \\ 2 \end{array} \right| \left. \begin{array}{l} 3 \\ 2 \\ 2 \end{array} \right\} \text{1st. diff.} \left\{ \begin{array}{l} 3+2 \\ 1 \\ 1 \end{array} \right| \left. \begin{array}{l} 5 \\ 1 \\ 1 \end{array} \right\} \text{2d. diff.} \left. \vphantom{\begin{array}{l} 5 \\ 1 \\ 1 \end{array}} \right\} \begin{array}{l} \text{differences} \\ \text{found as} \\ \text{before.} \end{array}$$

$$\overline{7} \text{ sums of the } \overline{7} \text{ differences.}$$

Then as 7 : 28, or as 1 : 4 : : 3 : 12*lb.* quantity of drugs at 5*s. per lb.*; and as 1 : 4 : : 2 : 8 *lb.* the quantity of 5*s.* and 4*s. per lb.* respectively : *Again,* for the second part of the question, as 7 : 42, or as 1 : 6 : : 5 : 30 *lb.* the quantity of 8*s. per lb.*; and as 1 : 6 : : 1 : 6*lb.* the quantity of 5*s.* and 4*s.* as was required.

POSITION; OR, THE RULE OF FALSE.

(2.) Suppose the person had 12 Portugal pieces,
then the one-third is 4
the one-fourth 3
and the one-sixth 2
the sum 9, the false conclusion; then as 9 : 54, or as 1 : 6 : : 12 : 72, the number of Portugal pieces.=*Ans.*

£
(3.) Suppose the price of the horse to be 2
then will the price of the harness be 1
and that of the chaise 6
the sum 9, the false conclusion; then as 9 : 60, or as 3 : 20 : : 2 : 13*l.* 6*s.* 8*d.* the price of the horse; then will the price of the harness be 6*l.* 13*s.* 4*d.* and chaise 40*l.* *respectively.*

(4.) Suppose A's part to be 12*l.*; then by the tenour of the question must B's be 16*l.* and C's 20*l.* Now 12+16 +20=48*l.* the false conclusion;

$$\begin{array}{l} \text{Then as } 48l. : 120l. :: \\ \text{Or, as } \quad 4l. : \ \ 10l. :: \end{array} \left\{ \begin{array}{l} 12l. : 30l. \\ 16l. : 40l. \\ 20l. : 50l. \end{array} \right\} \text{what} \left\{ \begin{array}{c} \text{A} \\ \text{B} \\ \text{C} \end{array} \right\} \text{pays}=\textit{A}.$$

(5.) Suppose the maid had got 2 geese;
then as many more is 2
and half as many more 1
sum=5, but should have been (30—5)=25; therefore, by the rule, as 5 : 25, or as 1 : 5 : : 2 : 10, the number of geese.=*Ans.*

£
(6.) Suppose the sum lent to have been 200
then the interest of the same for the time is 120
sum 320, the false conclusion; then as 320*l.* : 300*l.* : : 200*l.* : 187*l.* 10*s.* the sum lent.=*Ans.*

DOUBLE POSITION.

(2.) Suppose the weight of the least cup to be 1 *oz.*; then by the question $1+5=6$ *oz.* double the weight of the greater, and $3+5=8$ *oz.* which should have been $=3$ *oz.*; therefore the error is 5 *oz.* *Again*, suppose the weight of the least cup 5 *oz.*; then, by the question $5+5=10$ *oz.*, double the weight of the greater, and $5+5=10$ *oz.* which should have been $=15$ *oz.*; therefore the error is 5 *oz.*: here the errors are unlike, whence by the rule $\frac{(5\times 1)+(5\times 5)}{5+5}=$ 3 *oz.* weight of the least; and then will 4 *oz.* be the weight of the greater.

Or thus, Algebraically,

Let $x=$weight of the least cup, then $\frac{x+5}{2}$ will be the weight of the greater, to which add 5 *oz.* and we shall have $\frac{x+5}{2}+5=3\,x$; or $x+5+10=6\,x$ $\therefore 5\,x=15$, and $x=3$ *oz.* weight of the least, then $\frac{5+3}{2}=4$ *oz.*, weight of the greater.

(3.) Suppose A got 16 guineas;
then B got 32
and C 8
Sum $=56$, too little by 140.

Again, Suppose A got 34 guineas
then B got 50
and C 14
Sum $=98$, too little by 98.

Hence by the rule $\frac{(140\times 34)-(98\times 16)}{140-98}=76$, number A got
then B got 92
and C 28
196 proof.

Or thus,

Let x=number of guineas A got,

Then B got $x+16$, and C, $\frac{2x+16}{6}$

the sum, viz: $2x+16+\frac{2x+16}{6}=196$

or, $14x=1064$. $\therefore x=\frac{1064}{14}=76$, number A got.

then B got	76+16=	92
and C	168÷6	28
		196 proof.

(4.) Suppose the value of the horse £ 10
then the value of the garden is 40
and that of tho house 200
Sum=250 too little by 250

Again, Suppose the value of the horse 30
then the value of the garden is 120
and that of the house 600
Sum=750 too much by 250.

Hence by the rule $\frac{(250\times 30)+(250\times 10)}{250+250}=20l.$ value of the horse.

Then the value of the garden is= 80
and that of the house = 400
500 proof.

Or thus,

Let x represent the value of the horse
then $4x$ will be the value of the garden
and $20x$ that of the house

the sum $25x=£500$. $\therefore x=\frac{500}{25}=£20$. val. of the horse as before.

(5.) Suppose K's age 40, then is L's 40, but by the question it ought to have been 70, therefore the error is 30 in defect.—*Again*, suppose K's age 60, then is L's 120, but by the question it ought to have been 90, therefore the error is 30 in excess: Whence by the rule $\frac{(30\times60)+(30\times40)}{30+30}$ $=50$, K's age; hence L's$=80$.

Or thus,

Let

$x=$ L's age. Then by the question we shall have $30+30+\frac{x}{4}=x$, or $3x=240$

$$\therefore x=\frac{240}{3}=80 \text{ L's age.}$$

$$\begin{array}{rl} & 30 \text{ H's ,,} \\ 30+\frac{80}{4}= & 50 \text{ K's ,,} \\ & \overline{80} \text{ proof,} \end{array}$$

(6.) Suppose D got 15 *cr.* then E must have got 30 *cr.*, and F 9 *cr.* by the question: now $15+30+9=54$ *cr.*, therefore the error is 270 *cr.* in defect.—*Again*, suppose D got 150 *cr.*, then E must have got 165 *cr.*, and $F=\frac{1}{5}(150+165)=63$ *cr.*, by the question; now $150+165+63=378$ *cr.*, therefore the error is 54 in excess; hence by the rule $\frac{(150\times270)+(15\times54)}{270+54}=127\frac{1}{2}$, the number D got, then E got $142\frac{1}{2}$, and F 54.

Or thus,

Let $x=$No. of *cr.* D got, then E got $x+15$, and F, $\frac{2x+15}{5}$. The sum, viz. $2x+15+\frac{2x+15}{5}=324$. $\therefore 12x=1530$, and $x=127\frac{1}{2}$, the number D. got, as before.

(7.) Suppose A had	20 apples,	*Again*, sup. A had	36 apples.
then B got	10	then B got	18
add	10	add	10
	2)20		2)28
C got	10	C got	14
add	4	add	4
	2)14		2)18
and D	7	and D	9
add	1	add 1	1
	8		10
Too little by	5	Too little by	3

Now as the errors are alike, we have by the rule $\frac{(36\times5)-(20\times3)}{5-3}=60$, the number of apples required.

Or thus,

Let x=Number at first. Then $\frac{x}{2}+10$ = what he had when B left him. $\frac{1}{2}$ of this $=\frac{x}{4}+5$, to which add $4=\frac{x}{4}+9$, what he had when C left him. $\frac{1}{2}$ of $\frac{x}{4}+9=\frac{x}{8}+4\frac{1}{2}$, to which add $1=\frac{x}{8}+5\frac{1}{2}=13$: or $x+44=104$. ∴ $x=104-44=60$, the number of apples at first.

(8.) Suppose there were 6 ladies, then per question, $6+12=18$, which is 8 above 10, therefore the error is 4 in excess. *Again*, suppose there were 4 ladies, then, per question, $4+8=12$, which is 2 above 10, therefore the error is 4 in defect; whence by the rule $\frac{(6\times4)+(4\times4)}{4+4}=5$, the number required.

Or thus,

Let x=the number of ladies: then per question, $x+2x=3x$: and $3x-10=10-x$, or $4x=20$ ∴ $x=\frac{20}{4}=5=$ *Ans.*

EXCHANGE.

I. France.

(3.) Here as 1 *cr.* : 56*d.* :: 758 *cr.* : 42448*d.*=176*l.* 17*s.* 4*d.*=*Ans.*

(4.) Here as 56*d.* : 1 *cr.*::42448*d.*=(176*l.* 17*s.* 4*d.*= : 758 *cr.*=*Ans.*

(5.) Here as 720 deniers (or 1 *cr.*) : 54½*d.* :: 522211 deniers (or 725 *cr.* 17 *sols.* 7 *den.*) : $\frac{522211\times 54\frac{1}{2}}{720}$ = 39528¼*d.*$\frac{638}{720}$=£164 14*s.* 0¼*d.* $\frac{638}{720}$.=*Ans.*

(6.) Here as 218 *far.* (54½*d*,) : 1 *cr.*::£164 14*s.* 0½*d.* $\frac{638}{720}$: $\frac{113841998}{218\times 720}$=725 *cr.* 17 *sols.* 7 *den.*=*Ans.*

II. Spain

(7.) Here as 1 *piece of eight* : 56*d*,::2547 *pieces of eight*; 2547×56=142632*d.*=594*l.* 6*s.*=*Ans.*

(8.) Here as 56*d.* : 1 *piece of eight* :: 594*l.* 6*s.* : $\frac{594l.\ 6s.\times 20\times 12}{56}$=2547 *pieces of eight.*=*Ans.*

(9.) Here as 57½*d.* : 1 *piece of eight*, 600000*d.* (or 2500*l.*) : $\frac{600000\times 4}{57\frac{1}{2}\times 4}$=10434 *pieces of eight*, 6 *rials*, 8$\frac{20}{23}$ *mar.*=*Ans.*

III. Italy.

(10.) Here as 1 *dollar* : 53*d.* :: 976 *dollars* : 976×53 =51728*d.*=215*l.* 10*s.* 8*d.*=*Ans.*

(11.) Here as 53*d.* : 1 *dollar*::51728*d.*=(215*l.* 10*s.* 8*d.*) : $\frac{51728}{53}$=976 *dollars.*=*Ans.*

(12.) Here as 1 *ducatoon* : 54*d.*::200 *ducatoons* : 250 ×54=13500*d.*=56*l.* 5*s.*=*Ans.*

(13.) Here as 54*d.* : 1 *ducatoon*::13500*d.* or (56*l.* 5*s.*): $\frac{13500}{54}$=250 *ducatoons.*=*Ans.*

(14.) Here as 1 *ducat* : 53*d.*::275 *ducats* : 275 × 53 = 14575*d.*, which divided by 12 and 20, will give 60*l.* 14*s.* 7*d.* = *Ans.*

(15.) Here as 53*d.* : 1 *ducat*::14575*d.*=(60*l.* 14*s.* 7*d.*): $\frac{14575}{53}$=275 *ducats.*=*Ans.*

IV. PORTUGAL.

(16.) Here as 1 *milrea* : 77*d.*::2750 *milreas* : 2750 × 77=211750*d.*, which divided by 12 and 20, will give 882*l.* 5*s.* 10*d.*=*Ans.*

(17.) Here as 77*d.*: 1 *milrea*::211750*d.* (or 882*l.* 5*s.* 10*d.*): $\frac{211750}{77}$=2750 *milreas.*=*Ans.*

(18.) Here as 1000 *reas* : $65\frac{5}{8}$*d.*::4366183 *reas*=(4366 *milreas*, 183 *reas*) : $\frac{4366183 \times 65\frac{5}{8}}{1000}$ = $286530\frac{3}{4}$*d.* = 1193*l.* 17*s.* $6\frac{3}{4}$*d.*$\frac{75}{1000}$ =*Ans.*

(19.) Here as $65\frac{5}{8}$*d.* : 1 *m.* :: $286530\frac{6}{8}$*d.*$\frac{75}{1000}$. : $\frac{286530\frac{6}{8}d.\frac{75}{1000}}{65\frac{5}{8}} = \frac{2292246.075}{525}$ =4366 *milreas*, 183 *reas.*= *Ans.*

V. HOLLAND, FLANDERS, AND GERMANY.

(20.) Here as 1*l.* : $33\frac{1}{2}$*s.* : $754\frac{1}{2}$*l.* : 1263*l.* 15*s.* 9*d.* *flemish.*=*Ans.*

(21.) Here as 402*d.*=(33*s.* 6*d.* : 1*l.* :: 303309*d.*= (1263*l.* 15*s.* 9*d.*) : $\frac{303309}{402}$=754*l.* 10*s.*=*Ans.*

(22.) Here as 240*d.* : $412\frac{1}{2}$ *groats*, (or 34 *schellings*, $4\frac{1}{2}$ *groats*,) :: 204630*d.*=(852*l.* 12*s.* 6*d.*) : $\frac{204630 \times 412\frac{1}{2}}{240}$= 351707 *groats*, $6\frac{1}{2}$ *pennings*=8792 *guild.* 13 *stiv.* and $14\frac{1}{2}$ *pennings.*=*Ans.*

(23.) Here as 34 *schel.* $4\frac{1}{2}$ *gro.* : 1*l.* :: 8792 *guild.* 13 *stiv.* $14\frac{1}{2}$ *pen.* : 852*l.* 12*s.* 6*d.*=*Ans.*

NOTE.—This answer being the reverse of the last, we think it quite unnecessary to set down the reduction, &c. The same may be observed in many other instances.

How to convert Bank Money into Current, and Current into Bank, and vice versâ.

$$\begin{array}{lrcrrr}
 & \textit{guild. c.} & & \textit{guild. b.} & \textit{guild.} & \textit{stiv.}\ \textit{pen.} \\
\text{(24.) Here as} & 104\frac{3}{8} & : & 100 : & 794 & 15\quad 4 \\
 & 20 & & & 20 & \\
\hline
 & 2087\frac{4}{8} & & & 15895 & \\
 & 16 & & & 16 & \\
\hline
 & 33400 & & & 254324 & \\
 & & & & 100 & \\
\end{array}$$

$$33400)25432400(761\ \textit{guild.}\ 8\tfrac{328}{334}\ \textit{stivers}$$

(25.) Here as 100 *guild. b.* : $104\frac{3}{8}$ *guild. c.* : : 761 *guild.* $8\frac{328}{334}$ *stivers*, : 794 *guild.* 15 *stiv.* 4 *pen.*=*Ans.*

VI. IRELAND.

£ £ £ *s.* £ *s.* *d.*
(26.) Here as 100 : 110 : : 575 15 : 633 6 6.=*Ans.*
£ £ £ *s.* *d.* £ *s.*
(27.) Here as 110 : 100 : : 633 6 6 : 575 15.=*Ans.*

COMPARISON OF WEIGHTS AND MEASURES

(1.) Here as 65 *F. cr.* : 50 *D. p.* : : 350 *F. cr.* : $\frac{350\times50}{65}=269\frac{15}{65}$ Dutch pence.=*Ans.*

(2.) Here as 12 *yd. L.* : 8 *e. P.* : : 64 *ya. L.* : $\frac{64\times8}{12}=42\frac{8}{12}$ *e. P.*=*Ans.*

(3.) Here as 28*lb. A.* : 30*lb. L.* : : 350*lb.* A. : $\frac{350\times30}{28}=375$*lb. L.*=*Ans.*

(4.) Here as 95 *lb. F.* : 106 *lb. E.* : : 275 *lb. F.* : $\frac{275\times106}{95}=306\frac{80}{95}$*lb. E.*=*Ans.*

CONJOINED PROPORTION.

(2.) 12*lb.* London. = 10*lb.* Amsterdam.
100*lb.* Amsterdam. = 120*lb.* Thoulouse.
40*lb.* Thoulouse.

Then by the rule $\frac{140\times100\times40}{10\times120}=4\times10=40$*lb.*=*Ans.*

(3.) 140 *braces* Venice. = 156 *braces* Leghorn.
7 *braces* Leghorn. = 4 *ells English.*
16 *ells English.*

Then by the rule $\frac{140\times7\times16}{156\times4}=25\frac{80}{624}$ *braces.*=*Ans.*

(4.) 40*lb.* London. = 36*lb.* Amsterdam.
90*lb.* Amsterdam. = 116*lb.* Dantzick.
130lb. Dantzick.

Then by the rule $\frac{40\times90\times130}{36\times116}=112\frac{288}{4176}$*lb.*=*Ans.*

(5.) 12*lb.* London = 10*lb.* Amsterdam.
100*lb.* Amsterdam. = 120*lb.* Thoulouse.
How many *lbs.* Thoulouse. = 40*lb.* London.

Found thus,

$\frac{10\times120\times40}{12\times100}=10\times4=40$*lb.*=*Ans.*

(6.) 40*lb.* London = 36*lb.* Amsterdam.
90*lb.* Amsterdam = 116*lb.* Dantzick
How many *lbs.* Dantzick = 122*lb.* London.

Found thus,

$\frac{36\times116\times122}{40\times90}=141\frac{1872}{3600}$*lb.*=*Ans.*

ARITHMETICAL PROGRESSION.

Case I.

(2.) *By formula* 1 $s=\frac{n}{2}(f+l)=\frac{17}{2}\times(2+10)=\frac{17}{\cancel{2}}\times\frac{\overset{6}{\cancel{12}}}{1}$ $=120s.=5l.\ 2s.$ the sum of the series, or amount.=*Ans.*

(3.) It will be perceived from the question that the person must travel the ground twice over to gather the 100 stones, therefore the distance for the first stone will be 2 yards, and that for the last 200 yards, which therefore are the two extremes.

∴ *By formula* 1 we have $s=\frac{1}{2}n(f+l)=\frac{100}{2}\times(2+200)$ $=\frac{100}{\cancel{2}}\times\frac{\overset{101}{\cancel{202}}}{1}=10100$ *yds*$=5$ *miles* 1300 *yds*, the distance he must travel to gather up the 100 stones singly=*Ans.*

Case II.

(5.) Here, *by formula* 2, $d=\frac{l-f}{n-1}=\frac{58-3}{12-1}=\frac{55}{11}=5$ miles, daily increase.=1*st. Ans.* Then by *formula* 1, $s=\frac{n}{2}\times(f+l)$ $=\frac{12}{2}\times\frac{3+58}{1}=6\times61=366$ miles, the distance of the place from London.=2*nd Ans.*

Case III.

(7.) Here, *by formula* 3, $n=\frac{l-f}{d}+1=\frac{32-4}{4}+1=7+1=8$, the number of sons the man had.=*Ans.*

Case IV.

Here, *by formula* 4, $f=l-(n-1)d=46-(8-1)\times6=46-(7\times6)=46-42=4s.$ the number.=*Ans.*

GEOMETRICAL PROGRESSION.

Case I.

(2.) Here by the question, the common ratio is 2, the first term 1, and the number of terms 23.

The exponents or indices = 0, 1, 2, 3, 4, 5, &c.

The geometrical series = 1, 2, 4, 8, 16, 32, &c. farthings.

The sum of the indices $5+5+5+4+3=22$, one less than the number of terms.

The geometrical series corresponding to the indicos, *vis.* 5, 5, 5, 4, 3, are 32, 32, 32, 16, and 8; hence $32\times32\times32\times16\times8=4194304$ farthings=4369*l.* 1*s.* 4*d.* the price of the oxen.=*Ans.*

Or thus,

$l=fr^{n-1}=1\times2^{23-1}=2^{22}=4194304$ farthings=4369*l.* 1*s.* 4*d.*=the *Ans.* as before.

Case II.

(4.) Here by the question, the common ratio is 2, the first term 50, the number of terms 10.

The exponents or indices = 0, 1, 2, 3, 4, 5, &c.

The geometrical series = 50, 100, 200, 400, 800, 1600, &c., pounds.

The sum of the indices $4+5=9$, one less than the number of terms.

The geometrical series corresponding to the indices, *viz.* 4, and 5, are 800 and 1600; then $\frac{800\times1600}{50}=$ 25600*l.* the eldest son's portion.=*Ans.*

Or thus,

$l=fr^{n-1}=50\times2^{10-1}=50\times2^{9}=50\times512=25600$*l.* the eldest son's portion.=*Ans.* as before.

Case III.

(6.) Here, by the question, the common ratio is 3, the 1st term 1, and the number of terms 32.

The exponents or indices = 0, 1, 2, 3, 4, 5. &c.

The geometrical series = 1, 3, 9, 27, 81, 243, &c. farthings.

The sum of the indices $= 5+5+5+5+5+4+2=31$, one less than the number of terms.

The geometrical series corresponding to the indices *viz.* 5, 5, 5, 5, 5, 4 2, are 243, 243, 243, 243, 243, 81, 9; hence 243 × 243 × 243 × 243 × 243 × 81 × 9=617673396283947, the 32*nd* term.

Then by the rule $\frac{617673396283947 - 1}{3 - 1} + 617673396283947 = 308836698141973 + 617673396283947 = 926510094425920$ farthings=965114681693*l*. 13*s*. 4*d*.=*Ans.*

Or thus,

$s = \frac{f(r^n - 1)}{r - 1} = \frac{1 \times (3^{32} - 1)}{3 - 1} = \frac{1853020188851840}{2} = 926510094425920$ farthings = 965114681693*l*. 13*s*. 4*d*.=*Ans.* as before.

(7.) Here, by the question, the common ratio is 2, the first term 1, and the number of terms 12.

The exponents or indices = 0, 1, 2, 3. 4, 5, &c.
1, 2, 4, 8, 16, 32, &c. shillings.

The sum of the indices = 5+4+2=11, one less than the number of terms.

The geometrical series corresponding to the indices, *viz.* 5, 4, 2, are 32, 16, and 4; hence 32 × 16 × 4=2048, the 12th term.

Then, *by the Rule,* $\frac{2048 - 1}{2 - 1} + 2048 = 2047 + 2048 =$ 4095 shillings=204*l*. 15*s*.=*Ans.*

Or thus,

$s = \frac{f(r^n - 1)}{r - 1} = \frac{1 \times (2^{12} - 1)}{2 - 1} = \frac{4096 - 1}{2 - 1} = 4095$ shillings=204*l* 15*s*.=*Ans.* as before.

(8.) Here by the question, the common ratio is 3, the first term 2, and the number of terms 22.

The exponents or indices=0, 1, 2, 3, 4, 5, &c.
The geometrical series =2, 6, 18, 54, 162, 486, &c.

The sum of the indices=5+5+5+5+1=21 one less than the number of terms.

The geometrical series corresponding to the indices, *viz.* 5, 5, 5, 5, 1, are 486, 486, 486, 486, and 6.

NOTE.—The general rule is to make each index express the power of the ratio multiplied by the first term, when the first term differs from the ratio; therefore the series of indices have to begin with a nought and the sum of the indices is taken one less than the place of the required term; hence, in obtaining any required term from the sum of the indices, each product as it is found must be divided by the first term.

Hence $\frac{486\times486}{2}\times\frac{486}{2}\times\frac{486}{2}\times\frac{6}{2}=118098\times243$ $\times243\times3=20920706406$, the *22nd term.*

Then, *by the Rule,* $\frac{20920706406-2}{3-1}+20920706406$ $=10460353202+20920706406=31381059608$ the whole number of pins.

Then

31381059608÷100=31381059 farthings=326886 0 9
Now the cost price of the lace=22×7*l.* = 154 0 0
£326732 0 9 the gain.=*Ans.*

◆

PERMUTATION.

(2.) 1×2×3×4×5×6×7=5040 *days*=*Ans.*

◆

PART II.

REDUCTION OF VULGAR FRACTIONS.

CASE I.

(2.) $\left.\begin{array}{l}1\times4\times8=32\\3\times2\times8=48\\5\times2\times4=40\end{array}\right\}$ Numerators.
$2\times4\times8=64$, the Denominator.

Ans. $\frac{32}{64},\frac{48}{64}$, and $\frac{40}{64}$.

Note.—It will be perceived in this example that the denominators 2 and 4 are contained in 8, consequently 8 will be the least common denominator ∴ by dividing the least common denominator by each of the given denominators and multiplying the quotient by each respective numerator, we shall have $\frac{1}{2},\frac{3}{4},\frac{5}{8}=\frac{(8\div2)\times1}{8},\ \frac{(8\div4)\times3}{8},\ \frac{(8\div8)\times5}{8},$ $=\frac{4}{8},\frac{6}{8},\frac{5}{8}=\textit{Ans.}$

$$(3.)\quad \left.\begin{array}{l}3\times9\times10=270\\8\times5\times10=400\\7\times5\times\ 9=315\end{array}\right\}\text{Numerators.}$$

$$5\times9\times10=450,\ \text{the Denominator.}$$

$$\frac{270}{450},\frac{400}{450},\frac{315}{450}=\textit{Ans.}$$

Or thus,

$$\begin{array}{l}5\underline{)5,\ 9,\ 10}\\\ \ 1,\ 9,\ \ 2\end{array}\therefore 5\times1\times9\times2=90=\text{least common multiple.}$$

and $\frac{3}{5},\frac{8}{9}$, and $\frac{7}{10}=\frac{54}{90},\frac{80}{90}$, and $\frac{63}{90}=\textit{Ans.}$

$$(4.)\quad \left.\begin{array}{l}6\times\ 4\times7\times6=1008\\2\times10\times7\times6=\ 840\\1\times10\times4\times6=\ 240\\3\times10\times4\times7=\ 840\end{array}\right\}\text{Numerators.}$$

$$10\times\ 4\times7\times6=1680\ \ \text{the Denominator.}$$

$$\frac{1008}{1680},\frac{840}{1680},\frac{240}{1689},\frac{840}{1680}=\textit{Ans.}$$

$$(5.)\quad \left.\begin{array}{rr}4\times3\times7\times8= & 672\\2\times5\times7\times8= & 560\\3\times5\times3\times8= & 360\\\underline{1\times5\times3\times7=} & \underline{105}\\5\times3\times7\times8= & 840\end{array}\right\}\ \frac{672}{840},\frac{560}{840},\frac{360}{840},\ \text{and}\ \frac{105}{840}=\textit{Ans.}$$

$$(6.)\quad \left.\begin{array}{rr}2\times9\times8\times5= & 720\\5\times6\times8\times5= & 1200\\2\times6\times9\times5= & 540\\\underline{3\times6\times9\times8=} & \underline{1296}\\6\times9\times8\times5= & 2160\end{array}\right\}\ \frac{720}{2160},\frac{1200}{2160},\frac{540}{2160},\ \text{and}\ \frac{1296}{2163}=\textit{Ans.}$$

CASE II.

(8.) $\frac{30}{125}=\frac{6}{25}=$*Ans.* (9.) $\frac{208}{684}=\frac{52}{171}=$*Ans.*

(10.) 192)576(3
576
...

then $192)\frac{192}{576}(=\frac{1}{3}$*Ans.*

(11.) 825)960(1
825
135)825(6
810
gr. com. mea : 15(135(9

$\therefore 15)\frac{825}{960}(=\frac{55}{64}$*Ans.*

(12.) 5184)6912(1
5184
gr. com. mea. 1728(5184(3
5184

$\therefore)1728\frac{5184}{6912}(=\frac{3}{4}$*An*

Or thus,

$$\overset{\div 8}{\frac{5184}{6912}}=\overset{\div 8}{\frac{648}{864}}=\overset{\div 9}{\frac{81}{108}}=\overset{\div 3}{\frac{9}{12}}=\frac{3}{4}.$$ *Ans.*

CASE III.

(14.) $56\frac{13}{22}=\frac{(56\times 22)+13}{22}=\frac{1245}{22}=$*Ans.*

(15.) $183\frac{5}{21}=\frac{(183\times 21)+5}{21}=\frac{3848}{21}=$*Ans.*

(16.) $13\frac{4}{5}=\frac{(13\times 5)+4}{5}=\frac{69}{5}=$*Ans.*

(16.) $27\frac{2}{9}=\frac{(27\times 9)+2}{9}=\frac{245}{9}=$*Ans*

(18.) $514\frac{5}{16}=\frac{(514\times 16)+5}{16}=\frac{8229}{16}=$*Ans.*

CASE IV.

(20.) $\frac{1245}{22}=56\frac{13}{22}=$ *Ans.* (21.) $\frac{3848}{21}=183\frac{5}{21}=$ *Ans.*

(22.) $\frac{69}{5}=13\frac{4}{5}=$ *Ans.* (23.) $\frac{245}{9}=27\frac{2}{9}=$ *Ans.*

(24.) $\frac{8229}{16}=514\frac{5}{16}=$ *Ans.*

CASE V.

(26.) $\frac{5}{9}\times\frac{4}{7}\times\frac{11}{12}=\frac{220}{756}=\frac{55}{189}=$ *Ans.*

Or thus,

$$\frac{5}{9}\times\frac{\cancel{4}}{7}\times\frac{11}{\underset{3}{\cancel{12}}}=\frac{5\times11}{9\times7\times3}=\frac{55}{187}=Ans.$$

(27.) $\frac{11}{12}\times\frac{13}{14}\times\frac{21}{29}=\frac{3003}{4872}=\frac{143}{232}=$ *Ans*

Or thus,

$$\frac{11}{\underset{4}{\cancel{12}}}\times\frac{13}{\underset{2}{\cancel{14}}}\times\frac{\overset{3}{\cancel{21}}}{29}=\frac{143}{232}Ans.$$

(28.) $\frac{3}{4}\times\frac{5}{6}\times\frac{9}{10}=\frac{135}{240}=\frac{9}{16}=$ *Ans.*

Or thus,

$$\frac{\cancel{3}}{4}\times\frac{\cancel{5}}{\underset{2}{\cancel{6}}}\times\frac{9}{\underset{2}{\cancel{10}}}=\frac{9}{16}=Ans.$$

(29.) $\frac{4}{5}\times\frac{6}{8}\times\frac{7}{9}=\frac{168}{360}=\frac{7}{15}=$ *Ans.*

Or thus,

$$\frac{\cancel{4}}{5}\times\frac{\overset{\cancel{3}}{\cancel{6}}}{\underset{\cancel{2}}{\cancel{8}}}\times\frac{7}{\underset{3}{\cancel{9}}}=\frac{7}{15}=Ans.$$

(30.) $\frac{2}{7}\times\frac{5}{9}\times\frac{8}{10}=\frac{80}{630}=\frac{8}{63}=\textit{Ans.}$

Or, $\frac{\cancel{2}}{7}\times\frac{\cancel{5}}{9}\times\frac{8}{\underset{2}{\cancel{10}}}=\frac{8}{63}=\textit{Ans.}$

CASE VI.

(32.) $\frac{1}{4}\times\frac{1}{12}\times\frac{1}{20}=\frac{1}{960}=\textit{Ans.}$

(33.) $\frac{4}{5}\times\frac{1}{20}\times\frac{1}{12}=\frac{4}{1200}=\frac{1}{300}=\textit{Ans.}$

(34.) $\frac{\cancel{7}}{8}\times\frac{1}{\underset{16}{\cancel{112}}}=\frac{1}{128}\textit{cwt.}=\textit{Ans.}$

CASE VII.

(36.) Here $£\frac{1}{960}=\frac{1\times\cancel{20}\times\cancel{12}}{\underset{\underset{4}{\cancel{48}}}{\cancel{960}}}=\frac{1}{4}\textit{d.}=\textit{Ans.}$

(37.) $\frac{4}{1200}\textit{lb.}=\frac{4\times\cancel{12}\ \cancel{20}}{\underset{\underset{5}{\cancel{100}}}{\cancel{1200}}}=\frac{4}{5}\textit{dwt.}=\textit{Ans.}$

(38.) $\frac{4}{784}\textit{cwt.}=\frac{4\ \cancel{112}}{\underset{7}{\cancel{784}}}=\frac{4}{7}\textit{lb.}=\textit{Ans.}$

CASE VIII.

(40.) $\cancel{5}:7::\overset{5}{\cancel{25}}:35$ the denominator.

Hence $\frac{25}{35}=\textit{Ans.}$

(41.) $5:7::47:\frac{7\times47}{5}=\frac{329}{5}=65\frac{4}{5}$ the denominator.

Hence $\frac{47}{65\frac{4}{5}}=\textit{Ans.}$

CASE IX.

(43.) $\cancel{7}:5::\overset{5}{\cancel{35}}:25$ the numerator.

Hence $\frac{25}{35}=$ *Ans.*

(44.) $7:5::65\frac{4}{5}:\frac{5\times65\frac{4}{5}}{7}=5\times9\frac{2}{5}=47$ the numerator.

Hence $\frac{47}{65\frac{4}{5}}=$ *Ans.*

CASE X.

(46.) Here $\frac{23\frac{5}{7}}{38}=\frac{\frac{166}{7}}{38}=\frac{\overset{83}{\cancel{166}}}{7}\times\frac{1}{\underset{19}{\cancel{38}}}=\frac{83}{133}=$ *Ans*

(47.) $\frac{47}{65\frac{4}{5}}=\frac{47}{\frac{329}{5}}=\frac{47\times5}{1\times329}=\frac{235}{329}=\frac{5}{7}=$

(48.) $\frac{19}{44\frac{1}{3}}=\frac{19}{\frac{133}{3}}=\frac{19\times3}{1\times133}=\frac{57}{133}=\frac{3}{7}=$.

CASE XI.

(50.) $\frac{3}{8}s.=\frac{3\times12}{8}=\frac{36}{8}d.=4\frac{1}{2}d.=$ *Ans.*

(51.) $\frac{4}{7}\times\frac{16}{1}=\frac{64}{7}oz.=9oz.\ 2\frac{2}{7}dr.=$ *Ans.*

(52.) $\frac{7}{9}\times\frac{4}{1}=\frac{28}{9}qrs.=3qrs.\ 3lb.\ 1oz.\ 12$

(53.) $\frac{3}{5}\times\frac{12}{1}=\frac{36}{5}oz.=7oz.\ 4\ dwt.=$ *Ans.*

(54.) $\frac{5}{9}\times\frac{5}{1}=\frac{25}{9}qrs.=2qrs.\ 3\frac{1}{9}\ nails.=$ *A*

(55.) $\frac{4}{5}\times\frac{8}{1}=\frac{32}{5}$*fur.*=6 *fur.* 16 *poles.*=*Ans.*

(56.) $\frac{5}{\underset{2}{\cancel{8}}}\times\frac{\cancel{4}}{1}=\frac{5}{2}$*roods*=2*roods* 20*poles.*=*Ans.*

(57.) $\frac{6}{7}\times\frac{\overset{9}{\cancel{63}}}{1}$*gal.*=54 *gallons.*=*Ans.*

(58.) $\frac{3}{\cancel{9}}\times\frac{\overset{4}{\cancel{36}}}{1}$*gal.*=12 *gallons.*=*Ans.*

(59.) $\frac{5}{\cancel{12}}\times\frac{\overset{3}{\cancel{36}}}{1}$*bush.*=15 *bushels.*=*Ans*

(60,) $\frac{3}{5}\times\frac{4}{1}=\frac{12}{5}$*w.*=2*w.* 2*d.* 19$\frac{1}{5}$*h.*=*Ans*

Case XII.

(61.) $\frac{15}{20}=\frac{3}{4}$=*Ans.*

(62.) 4*d.* 3$\frac{1}{5}$*q.*=19$\frac{1}{5}$*q.*.$\therefore\frac{19\frac{1}{5}}{48}$*s.*$=\frac{96}{240}=\frac{2}{5}$*s.*=*Ans.*

(63.) 9*oz.* 2$\frac{2}{7}$*dr.*=9$\frac{1}{7}$*oz.*.$\therefore\frac{9\frac{1}{7}}{16}$*lb.*$=\frac{64}{112}=\frac{4}{7}$*lb.*=*Ans.*

(64.) 3*qrs.* 3*lb.* 1*oz.* 12$\frac{4}{9}$*dr.*=22300$\frac{4}{9}$.*dr.*$\therefore\frac{22300\frac{4}{9}}{28672}$*c*
$=\frac{200704}{258048}=\frac{7}{9}$*cwt.*=*Ans.*

(65.) 6*oz.* 15*dwts.*=6$\frac{3}{4}$*oz.*.$\therefore\frac{6\frac{3}{4}}{12}$*lb.*$=\frac{27}{48}=\frac{9}{16}$*lb.*=*Ans.*

(66.) 2*qrs.* 3$\frac{1}{9}$*nails*=2$\frac{7}{9}$*qrs.* $\therefore\frac{2\frac{7}{9}}{5}$*e. e.*$=\frac{25}{45}=\frac{5}{9}$*e.e.*=

(67.) 6*fur.* 16*poles*=6$\frac{2}{5}$ *fur.* $\therefore\frac{6\frac{2}{5}}{8}$*m.*$=\frac{32}{40}=\frac{4}{5}$*mile.*=

(68.) 2*roods* 20*poles*$=2\frac{1}{2}$*roods*$\therefore\frac{2\frac{1}{2}}{4}$*ac.*$=\frac{5}{8}$*acre.*$=$*Ans.*

(69.) Here $\frac{54}{63}$*hhd.*$=\frac{6}{7}$*hhd.*$=$*Ans.*

(70.) Here $\frac{12}{36}$*bar.*$=\frac{1}{3}$*barrel.*$=$*Ans.*

(71.) Here $\frac{15}{36}$*ch.*$=\frac{5}{12}$*chaldron.*$=$*Ans.*

(72.) Here 2*w.* 2*d.* $19\frac{1}{5}$*h.*$=403\frac{1}{5}$*hours.* Hence $\frac{403\frac{1}{5}}{672}$*m.*
$=\frac{2016}{3360}=\frac{3}{5}$*month.*$=$*Ans.*

ADDITION OF VULGAR FRACTIONS.

Here by Case I. Rule I. $\frac{3}{4}+\frac{2}{7}+\frac{5}{6}=\frac{126}{168}+\frac{48}{168}$
$=\frac{140}{168}=\frac{314}{168}=1\frac{146}{168}$, or $1\frac{73}{84}=$*Ans.*

Or thus, $2\overline{)4,7,6}$

$\quad 2,7,3$

$2\times2\times7\times3=84$ the least common denominator.

$$\frac{84}{4}\times3=63$$
$$\frac{84}{7}\times2=24$$
$$\frac{84}{6}\times5=70$$
$$\frac{157}{84}=1\frac{73}{84}=\textit{Ans.}$$

(3.) $\frac{1}{5}+\frac{2}{5}+\frac{3}{5}$, and $\frac{3}{5}+4\frac{1}{3}=\frac{9}{15}+4\frac{5}{15}=4\frac{14}{15}$.

Or, $\frac{1}{5}+\frac{13}{3}+\frac{2}{5}=\frac{15}{75}+\frac{325}{75}+\frac{30}{75}=\frac{370}{75}=4\frac{70}{75}=4\frac{14}{15}$*Ans.*

(4.) $\frac{2}{3}+\frac{2}{5}=\frac{10}{15}+\frac{6}{15}=\frac{16}{15}=1\frac{1}{15}$; and $7+1\frac{1}{15}=8\frac{1}{15}$*A*

(5.) $\frac{2}{3}$ of $\frac{3}{4}=\frac{1}{2}$; and $\frac{2}{7}+\frac{1}{2}=\frac{4}{14}+\frac{7}{14}=\frac{11}{14}=$ *Ans.*

(6.) $\frac{2}{3}+\frac{7}{8}+\frac{1}{2}=\frac{2}{3}+\frac{7}{8}+\frac{4}{8}=\frac{2}{3}+\frac{11}{8}=\frac{16}{24}+\frac{33}{24}=\frac{49}{24}=2\frac{1}{24}$. Then, $5+6+4+2\frac{1}{24}=17\frac{1}{24}=$ *Ans.*

$$\begin{array}{lrr} & s. & d. \\ \text{(7.) Here } \frac{3}{\cancel{4}}\times\frac{\overset{5}{\cancel{20}}}{1}\ldots\ldots\ldots & =15 & 0 \\ \text{and } \frac{5}{\cancel{6}}\times\frac{\overset{2}{\cancel{12}}}{1}\ldots\ldots\ldots & = & 10 \\ \hline \textit{Sum}= & 15 & 10=\textit{Ans.} \end{array}$$

$$\begin{array}{lrr} & s. & d. \\ \text{(8.) Here } \frac{2}{3}\times\frac{20}{1}=\frac{49}{3}s. & =13 & 4 \\ \text{and } \frac{1}{2}\ldots\ldots\ldots & = & \frac{1}{2} \\ \hline \textit{Sum}= & 13 & 4\frac{1}{2}=\textit{Ans.} \end{array}$$

$$\begin{array}{lrrr} & oz & dwt. & gr. \\ \text{(9.) Here } \frac{3}{\cancel{4}}\times\frac{\overset{3}{\cancel{12}}}{1}\ldots\ldots\ldots & =9 & 0 & 0 \\ \text{and } \frac{1}{\underset{3}{\cancel{6}}}\times\frac{\overset{10}{\cancel{20}}}{1}=\frac{10}{3}dwts. & = & 3 & 8 \\ \hline \textit{Sum}= & 9 & 3 & 8=\textit{Ans.} \end{array}$$

$$\begin{array}{lrrrrr} & cwt. & qr. & lb. & oz. & dr. \\ \text{(10.) Here } \frac{4}{\cancel{5}}\times\frac{\overset{4}{\cancel{20}}}{1} & =16 & 0 & 0 & 0 & 0 \\ \text{and } \frac{5}{\underset{3}{\cancel{6}}}\times\frac{\overset{8}{\cancel{16}}}{1}=\frac{40}{3}oz.= & & & & 13 & 5\frac{1}{3} \\ \hline \textit{Sum}= & 16 & 0 & 0 & 13 & 5\frac{1}{3}=\textit{Ans.} \end{array}$$

12 *bush. pecks.*

(11.) Here $\frac{2}{\cancel{3}}\times\frac{\cancel{36}}{1}=24\quad 0$

and $\frac{3}{\cancel{4}}\times\frac{\cancel{4}}{1}=\quad 3$

Sum $=24\quad 3=$ *Ans.*

6 *in. b.c.*

(12.) Here $\frac{1}{\cancel{6}}\times\frac{\cancel{36}}{1}=6\quad$ C

and $\frac{2}{\cancel{3}}\times\frac{\cancel{3}}{1}=\quad 2$

Sum $=6\quad 2=$ *Ans.*

SUBSTRACTION OF VULGAR FRACTIONS.

(2.) Here $\frac{5}{6}-\frac{3}{8}=\frac{(24\div 6)\times 5}{24}-\frac{(24\div 8)\times 3}{24}=\frac{20}{24}-\frac{9}{24}=\frac{11}{24}=$ *Ans.*

(3.) Here $\frac{17}{3}-\frac{9}{10}=\frac{17\times 10}{3\times 10}-\frac{9\times 3}{3\times 10}=\frac{170}{30}-\frac{27}{30}=\frac{143}{30}=4\frac{23}{30}=$ *Ans.*

(4.) Here $\frac{38}{47}-\frac{3}{5}=\frac{5\times 38}{47\times 5}-\frac{47\times 3}{47\times 5}=\frac{190}{235}-\frac{141}{235}=\frac{49}{235}=$ *Ans.*

(5.) Here $\frac{19}{20}-\frac{2}{21}=\frac{21\times 19}{420}-\frac{20\times 2}{420}=\frac{399}{420}-\frac{40}{420}=\frac{359}{420}=$ *Ans.*

(6.) Here $64\frac{1}{4}-\frac{2}{4}=63\frac{3}{4}=$ *Ans.*

s. *d.*

(7.) Here $\frac{3}{\cancel{4}}\times\frac{\overset{5}{\cancel{20}}}{1}=15\quad 0$

and $\frac{3}{\cancel{4}}\times\frac{\overset{3}{\cancel{12}}}{1}=\quad 9$

Diff.$=14\quad 3=$ *Ans.*

(8.) Here $\frac{2}{\cancel{3}}\times\frac{\overset{4}{\cancel{12}}}{1}=8d.$

½*d.*

Diff.$=7\frac{1}{2}d.=$ *Ans.*

oz *dwt.* *gr.*

(9.) Here $\frac{3}{\cancel{4}}\times\frac{\overset{3}{\cancel{12}}}{1}\quad=9\quad 0\quad 0$

and $\frac{1}{\underset{3}{\cancel{6}}}\times\frac{\overset{10}{\cancel{20}}}{1}=\frac{10}{3}=\quad 3\quad 8$

Diff.$=8\quad 16\quad 16=$ *Ans*

cwt. *qr.* *lb.* *oz.* *dr.*

(10.) Here $\frac{4}{\cancel{5}}\times\frac{\overset{4}{\cancel{20}}}{1}=16\quad 0\quad 0\quad 0\quad 0$

and $\frac{5}{\underset{3}{\cancel{6}}}\times\frac{\overset{8}{\cancel{16}}}{1}=\frac{40}{3}=\quad 13\quad 5\frac{1}{3}$

Diff.$=15\quad 3\quad 27\quad 2\quad 10\frac{2}{3}=$ *Ans.*

bush. *pecks.*

(11.) Here $\frac{2}{\cancel{3}}\times\frac{\overset{12}{\cancel{36}}}{1}=24\quad 0$

and $\frac{3}{\cancel{4}}\times\frac{\cancel{4}}{1}=\quad 3$

Diff.$=23\quad 1=$ *Ans.*

$$\begin{array}{lrr} & \textit{in.} & \textit{b.c.} \\ \text{(12.) Here } \frac{1}{\cancel{6}}\times\frac{\overset{6}{\cancel{36}}}{1}= & 6 & 0 \\ \text{and } \frac{2}{\cancel{3}}\times\frac{\cancel{3}}{1}= & & 2 \\ \hline \textit{Diff.}= & 5 & 1=\textit{Ans.} \\ \hline\hline \end{array}$$

MULTIPLICATION OF VULGAR FRACTIONS.

(2.) $\frac{7}{9}\times\frac{2}{3}=\frac{14}{27}=\textit{Ans.}$

(3). $48\frac{3}{5}\times13\frac{5}{6}=\frac{243}{5}\times\frac{83}{6}=\frac{20169}{30}=672\frac{9}{30}=\textit{Ans.}$

Or, $\frac{\overset{81}{\cancel{243}}}{5}\times\frac{83}{\underset{2}{\cancel{6}}}=\frac{6723}{10}=672\frac{3}{10}=\textit{Ans.}$

(4.) $430\frac{6}{10}\times18\frac{3}{7}=\frac{4306}{10}\times\frac{129}{7}=\frac{555474}{70}=7935\frac{24}{70}$ $=\textit{Ans.}$

(5.) $\frac{16}{\underset{7}{\cancel{21}}}\times\frac{\cancel{3}}{\cancel{4}}\times\frac{\cancel{5}}{7}\times\frac{\cancel{4}}{\cancel{5}}=\frac{16}{49}=\textit{Ans.}$

(6.) $\frac{\overset{3}{\cancel{9}}}{\underset{2}{\cancel{10}}}\times\frac{\cancel{2}}{\cancel{3}}\times\frac{\cancel{3}}{4}\times\frac{\cancel{5}}{\underset{\cancel{3}}{\cancel{6}}}=\frac{3}{8}=\textit{Ans.}$

(7.) $\frac{\cancel{3}}{\underset{\cancel{2}}{\cancel{4}}}\times\frac{\cancel{2}}{\cancel{3}}\times\frac{\cancel{2}}{3}\times\frac{1}{3}=\frac{1}{9}=\textit{Ans.}$

8.) $\frac{1}{4}\times\frac{3}{8}\times\frac{5}{7}=\frac{15}{224}=\textit{Ans.}$

(9.) $\frac{41}{7}\times\frac{5}{6}=\frac{205}{42}=4\frac{37}{42}=\textit{Ans.}$

(10.) $\frac{24}{1}\times\frac{2}{3}=\frac{48}{3}=16=\textit{Ans.}$

(11.) $9\frac{1}{2}\times\frac{1}{3}=\frac{19}{2}\times\frac{1}{3}=\frac{19}{6}=3\frac{1}{6}=\textit{Ans.}$

(12.) Here $\pounds 3\frac{1}{6}\times\pounds 3\frac{1}{6}=\frac{19}{6}\times\frac{19}{6}=\frac{361}{36}=\pounds 10\ \ 0\ \ 6\frac{1}{2}\frac{2}{3}\,\textit{A}$

DIVISION OF VULGAR FRACTIONS.

(2.) $\frac{14}{27}\div\frac{2}{3}=\frac{\overset{7}{\cancel{14}}}{\underset{9}{\cancel{27}}}\times\frac{\cancel{3}}{\cancel{2}}=\frac{7}{9}=\textit{Ans.}$

(3.) $672\frac{9}{30}\div 13\frac{5}{6}=\frac{\overset{243}{\cancel{20169}}}{\underset{5}{\cancel{35}}}\times\frac{\cancel{6}}{\cancel{83}}=\frac{243}{5}=48\frac{3}{5}=\textit{Ans.}$

(4.) $7935\frac{24}{70}\div 18\frac{3}{7}=\frac{\overset{2153}{\cancel{277737}}}{\underset{5}{\cancel{35}}}\times\frac{\cancel{7}}{\cancel{129}}=\frac{2153}{5}=430\frac{3}{5}=\textit{Ans.}$

(5.) $\frac{3}{8}\div\left(\frac{2}{3}\times\frac{3}{4}\times\frac{5}{6}\right)=\frac{3}{\underset{2}{\cancel{8}}}\times\frac{\cancel{3}}{\cancel{2}}\times\frac{\cancel{4}}{\cancel{3}}\times\frac{\overset{3}{\cancel{6}}}{5}=\frac{9}{10}=\textit{Ans.}$

(6.) $\left(\frac{2}{3}\times\frac{16}{1}\right)\div\left(\frac{5}{7}\times\frac{3}{4}\right)=\frac{2}{3}\times\frac{16}{1}\times\frac{7}{5}\times\frac{4}{3}=\frac{896}{45}=$
$19\frac{41}{45}=\textit{Ans.}$

(7.) $\left(\frac{1}{2}\times\frac{2}{3}\right)\div\left(\frac{2}{3}\times\frac{3}{4}\right)=\frac{1}{\cancel{2}}\times\frac{\cancel{2}}{\cancel{3}}\times\frac{\cancel{3}}{\cancel{2}}\times\frac{\overset{2}{\cancel{4}}}{3}=\frac{2}{3}=\textit{Ans.}$

(8.) $\frac{110}{12}\div\left(\frac{1}{2}\times\frac{7}{1}\right)=\frac{\overset{55}{\cancel{110}}}{\underset{\underset{3}{\cancel{6}}}{\cancel{12}}}\times\frac{\cancel{2}}{1}\times\frac{1}{7}=\frac{55}{21}=2\frac{13}{21}=\textit{Ans.}$

(9.) $\frac{5}{1}\div\frac{7}{10}=\frac{5}{1}\times\frac{10}{7}=\frac{50}{7}=7\frac{1}{7}=\textit{Ans.}$

(10.) $\frac{16}{1}\div\frac{24}{1}=\frac{\overset{2}{\cancel{16}}}{1}\times\frac{\cancel{1}}{\underset{3}{\cancel{24}}}=\frac{2}{3}=\textit{Ans.}$

(11.) $5205\frac{1}{5}\div\left(\frac{4}{5}\times\frac{91}{1}\right)=\frac{\overset{\overset{143}{\cancel{286}}}{\cancel{26026}}}{\cancel{5}}\times\frac{\cancel{5}}{\underset{2}{\cancel{4}}}\times\frac{1}{\cancel{91}}=\frac{143}{2}=71\frac{1}{2}$ *Ans.*

(12.) $3\frac{1}{6}\div 9\frac{1}{2}=\frac{\cancel{19}}{\underset{3}{\cancel{6}}}\times\frac{\cancel{2}}{\cancel{19}}=\frac{1}{3}=$ *Ans.*

THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

(2,) As $\frac{5}{6}$*yd.* : $\frac{2}{3}$*l.* :: $\frac{11}{12}$*yd.* : $\frac{6\times2\times11}{5\times3\times12}=\frac{11}{5\times3}=\frac{11}{15}$*l.* = 14*s.* 8*d.* = *Ans.*

(3.) As $\frac{5}{7}$*cwt.* : $\frac{11}{12}$*l.* :: $\frac{1}{1}$*cwt.* : $\frac{7\times11\times1}{5\times12\times1}=\frac{77}{60}=$ £1 5 8 = *A.*

(4.) As $\frac{3}{4}$*s.* : $\frac{7}{8}$*lb.* :: $\frac{8}{9}$*s.* : $\frac{4\times7\times8}{3\times8\times9}=\frac{7\times4}{3\times9}=\frac{28}{27}$*lb.* = $1\frac{1}{27}$*lb.* = *A.*

(5) As $\frac{3}{5}$*ell.* : $\frac{1}{3}$*l.* :: $\frac{38}{3}$*ell.* : $\frac{5\times1\times38}{3\times3\times3}=$ 7*l.* 0*s.* $8\frac{3}{4}$*d.* $\frac{5}{9}$*q.* = *Ans.*

(6.) As $\frac{25}{2}$*yd.* : $15\frac{3}{4}$*s.* :: $\frac{193}{4}$*yd.* : $\frac{2\times63\times193}{25\times4\times4}=$ 3*l.* 0*s.* $9\frac{1}{2}$*d.* $\frac{4}{25}$*q.* = *Ans.*

(7.) As $\frac{9}{10}$*cwt.* : $\frac{284}{1}$*s.* :: $\frac{15}{2}$*cwt.* : $\frac{10\times15\times284}{9\times2\times1}=\frac{284\times25}{3}$ = 118*l.* 6*s.* 8*d.* = *Ans.*

(8.) As $\frac{3}{1}$*yd.* : $\frac{14}{5}$*l.* :: $\frac{72}{7}$*yd.* : $\frac{1\times14\times72}{3\times5\times7}=\frac{2\times3\times8}{5}=\frac{48}{5}=$ 9*l.* 12*s.* = *Ans.*

(9.) As $\frac{1}{1}$*qr*, : $\frac{2}{3}$*l.* :: $\frac{3}{1}$*qr.* (*or* $\frac{3}{5}$ *of an ell.*) : $\frac{1\times2\times3}{1\times3\times1}=$ 2*l.* = *A.*

(10.) As $\frac{1}{1}$*lb.* : $1\frac{1}{4}$*l.* :: $\frac{367}{10}$*lb.* : $\frac{1\times5\times367}{1\times4\times10}=\frac{367}{8}=$ 45*l.* 17*s.* 6*d.* = *Ans.*

(11.) As $\frac{1}{1}$*yd.* : $\frac{125}{8}$*s.* :: $\frac{192\times4}{7}$*yds.* : $\frac{1\times125\times192\times4}{1\times8\times7}=$ $\frac{12000}{7}$=85*l.* 14*s.* 3¼*d.* $\frac{5}{7}$*q.*=*Ans.*

(12.) As $\frac{1}{1}$*ell.* : $\frac{291}{4}$*d.* :: $\frac{7\times195}{2\times8}$*ells.* : $\frac{1\times291\times7\times195}{1\times4\times2\times8}$=25*l* 17*s.* 2¼*d.* $\frac{15}{16}$*q.*=*Ans.*

SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

(1.) As $\frac{28}{1}$*m.* : $\frac{203}{4}$*d.* :: $\frac{12}{1}$*m.* : $\frac{\overset{7}{\cancel{28}}\times203\times1}{1\times\cancel{4}\times12}=\frac{1421}{12}=118$ $\frac{5}{12}$*m.*=*Ans.*

(2.) As $\frac{1}{1}$*cwt.* : $\frac{581}{4}$*m.* :: $\frac{13}{2}$*cwt.* : $\frac{1\times581\times2}{1\times4\times13}=\frac{581}{2\times13}=$ $22\frac{9}{29}$*m.*=*Ans.*

(3.) As $\frac{6}{5}$*yd.* : $\frac{13}{4}$*yd.* :: $\frac{4}{5}$*yd.* : $\frac{6\times13\times5}{5\times4\times4}=\frac{6\times13}{4\times4}=\frac{78}{16}=$ $4\frac{7}{8}$*yds.*=*Ans.*

(4.) As $\frac{3}{1}$*m.* : $\frac{9}{2}$*hr.* :: $\frac{10}{1}$*m.* : $\frac{3\times9\times1}{1\times2\times10}=\frac{27}{20}=1\frac{7}{20}$*hr.*=*Ans.*

(5.) As $\frac{7}{1}$*oz.* : $\frac{11}{2}$*s.* :: $\frac{5}{2}$*oz.* : $\frac{7\times11\times2}{1\times2\times5}=\frac{7\times11}{5}$=15*s.* $4\frac{4}{5}$=*A*

(6.) As $\frac{3}{2}$*yd.* : $\frac{15}{2}$*yd.* :: $\frac{3}{4}$*yd.* : $\frac{3\times15\times4}{2\times2\times3}$=15*yds.*=*Ans.*

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

(1.) $\left.\begin{array}{l}\frac{3}{1}\textit{cwt.} : \frac{63}{8}\textit{cwt.}\\ \frac{150}{1}\textit{m.} : \frac{50}{1}\textit{m.}\end{array}\right\} :: \frac{21}{10}\textit{l.}$

Hence $\frac{\overset{21}{\cancel{63}}}{8}\times\frac{\cancel{50}}{1}\times\frac{\overset{7}{\cancel{21}}}{10}\times\frac{1}{\cancel{3}}\times\frac{1}{\underset{3}{\cancel{150}}}=\frac{147}{80}=1\frac{67}{80}$=£1 16*s.* 9*d.* =*Ans.*

(2.) $\left.\begin{array}{l}\frac{6}{1}l. : \frac{27}{8}l.\\ \frac{9}{1}m. : \frac{12}{1}m.\end{array}\right\} :: \frac{100}{1}l$

Hence $\frac{\overset{3}{\cancel{27}}}{\underset{\cancel{2}}{\cancel{8}}}\times\frac{\overset{\cancel{2}}{\cancel{12}}}{1}\times\frac{\overset{25}{\cancel{100}}}{1}\times\frac{1}{\cancel{6}}\times\frac{1}{9}=75l.=$*Ans.*

(3.) $\left.\begin{array}{l}\frac{18}{1}\textit{ days} : \frac{30}{1}\textit{ days}\\ \frac{9}{1}\textit{ stu.} : \frac{20}{1}\textit{ stu.}\end{array}\right\} :: \frac{97}{9}l.$

Hence $\frac{1}{18}\times\frac{1}{9}\times\frac{30}{1}\times\frac{20}{1}\times\frac{97}{9}=\frac{58200}{1458}l.=39l.\ 18s.\ 4\frac{360}{1458}d.$ $=$*Ans.*

Or, by cancelling the terms, $\frac{1}{\underset{3}{\cancel{18}}}\times\frac{1}{9}\times\frac{\overset{5}{\cancel{30}}}{1}\times\frac{20}{1}\times\frac{97}{9}=\frac{9700}{243}l.$
$=39l.\ 18s.\ 4\frac{20}{81}d.=$*Ans.*

(4.) $\left.\begin{array}{l}\frac{1}{1}\textit{ day} : \frac{21}{2}\textit{ day}\\ \frac{2}{1}\textit{ persons} : \frac{4}{1}\textit{ persons}\end{array}\right\} :: \frac{37}{8}s.$

Hence $\frac{1}{2}\times\frac{21}{2}\times\frac{\cancel{4}}{1}\times\frac{37}{\underset{2}{\cancel{8}}}=\frac{777}{8}s.=4l.\ 17s.\ 1\frac{1}{2}d.=$*Ans.*

(5.) $\left.\begin{array}{l}\frac{40}{3}l. : \frac{50}{1}l.\\ 2\frac{37}{144}l. : 1\frac{1}{12}l.\end{array}\right\} :: 5$ *months.*

Hence $\frac{3}{\underset{\underset{\cancel{2}}{\cancel{8}}}{\cancel{40}}}\times\frac{\overset{\overset{3}{\cancel{12}}}{\cancel{144}}}{\underset{\cancel{25}}{\cancel{325}}}\times\frac{\overset{\cancel{2}}{\cancel{50}}}{1}\times\frac{\cancel{13}}{\cancel{12}}=\frac{5}{1}=9$ *months.*$=$*Ans.*

(6.) $\left.\begin{array}{l}\frac{30}{1}m. : \frac{20}{1}m.\\ \frac{29}{2}l. : 5\frac{7}{16}l.\end{array}\right\} :: 60cwt.$

Hence $\frac{1}{\cancel{30}}\times\frac{\cancel{2}}{\cancel{29}}\times\frac{\overset{5}{\cancel{20}}}{1}\times\frac{\overset{3}{\cancel{87}}}{\underset{\cancel{4}}{\cancel{16}}}\times\frac{\overset{\cancel{2}}{\cancel{60}}}{1}=15$ *cwt.*$=$*Ans.*

DECIMAL FRACTIONS.

ADDITION OF DECIMALS.

(1.)
72·5
32·071
2·1574
371·4
2·75
480·8784
961·7568

(2.)
30·07
2·0071
59·4
3207·1
3298·5771

(3.)
3·5
47·25
927·01
2·0073
1·5
981·2673

(4.)
52·75
47·21
724·
31·452
3075·
3930·412

(5.)
3275·
27·514
1·005
725·
7·32
4035·839

(6.)
27·5
52·
3·2075
5741·
2720·
8543·7075

SUBTRACTION OF DECIMALS.

(1.)
·2754
·2371
·0383

(2.)
2·37
1·76
·61

(3.)
271·
215·7
55·3

(4.)
270·2
76·4075
193·7925

(5.)
571·
54·72
516·28

(6.)
625·
76·91
548·09

(7.)
23·415
·3742
23·0408

(8.)
·107
·0007
·1063

MULTIPLICATION OF DECIMALS.

(1.)
·2365
·2435
Prod. ·05758775

(2.)
2·071
2·27
4·70117

(3.)
27·15
25·3
686·895

(4.)	79347·	(5.)	17105·	(6.)	17105·
	23·15		·3257		·0237
Prod.	1836883·05		5571·0985		405·3885

(7.)	7·70071	(8.)	5·721	(9.)	2·07
	27·35		·0075		·007
Prod.	210·6144185		·0429075		·01449

(10.)	20·15	(11.)	·907
	·2705		·0025
Prod.	5·450575		·0022675

CONTRACTED MULTIPLICATION OF DECIMALS.

(13.)	3·141592	(14.)	2·38645	(15.)	375·13758
	8347'25		5712·8		4237·61
	1570796		190916		37514
	62831		4773		22508
	21991		239		2626
	1257		167		113
	94		12		8
	25	Prod.	19·6107		6276·9
Prod.	165·6994				

(16.)	375·13758	(17.)	395·3756
	4237·61		24657·
	37513758		2767629
	22508255		197688
	2625963		23722
	112541		1582
	7503		79
	1500		299·0700
Prod.	6276·9520		

Note.—We need not make use of any more figures in our multiplier han what stand even with our multiplicand to the left, as in Example 15.

DIVISION OF DECIMALS.

(1.) 6·321)8564·825(1354·9=*Ans.*
6321
22438
18963
34752
31605
31475
25284
61910
56889
5021

(2.) 144)48·000(33·33′=*An*
432
480
432
480
432
480
432
48

Quotients.	*Remainders.*	*Quotients.*	*Remainde*
(3.) 3·35	0	(8.) ·0000197	17
(4.) 1196·17	235.	(9.) 213·727	100
(5.) 275·4	1204	(10.) 535·6	110
(6.) ·00069	425	(11.) 2325·2	100
(7) 1148.99	49452		

CONTRACTED DIVISION OF DECIMALS.

(13.) 5·2714167)8·758615(1·661=*Ans.*
5271
3487
3163
324
316
8
5
3

(14.) 8·7586)51717591·(5904778·275=*Ans.*
(15.) 217·35)25·1367(·115=*Ans.*
(16.) 123415)51·47542(417·092=*Ans.*
(17.) 7·9863)70·23(8·793=*Ans.*
(18.) 3·712)27·104(7·301=*Ans.*

REDUCTION OF DECIMALS

CASE I.

(2.) $\frac{1}{2}=1{\cdot}0\div2={\cdot}5$ decimal; for 2 : 1 :: 1·0 : ·5=*Ans.*

(3.) $\frac{3}{4}=3{\cdot}00\div4={\cdot}75$ decimal; for 4 : 3 :: 1·00: ·75=*A*

(4.) $\frac{3}{8}=3{\cdot}000\div8={\cdot}375$ decimal; for 8 : 3 :: 1·000 : ·375=*Ans.*

(5.) $\frac{5}{26}=5{\cdot}0000\div26={\cdot}1923076+$decimal; for 26 : 5 :: 1·0000 : ·1923076+=*Ans.*

(6.) Here $\frac{11}{14}$ of $\frac{10}{13}=\frac{110}{182}=\frac{55}{91}={\cdot}6043956+$decimal req.

(7.) $$\begin{array}{r|l} & \textit{s.} \\ 20 & 5 \\ \hline \text{Ans.}= & {\cdot}25 \end{array}$$

(8.) $$\begin{array}{r|l} & \textit{s.} \\ 20 & 9 \\ \hline \text{Ans.}= & {\cdot}45 \end{array}$$

(9.) $$\begin{array}{r|l} & \textit{s.} \\ 20 & 16 \\ \hline \text{Ans.}= & {\cdot}8 \end{array}$$

(10.) $$12s.\ 6d.=12\tfrac{1}{2}s.=\tfrac{25}{2}s.=\frac{25}{2\times20}=\overset{\pounds}{9}25.\ \text{Ans.}$$

Or, by Note 2nd.

$$\begin{array}{r|l} 12 & 6{\cdot} \\ 20 & 12{\cdot}5 \\ \hline & {\cdot}625=\text{Ans.} \end{array}$$

(12.) $\frac{4\frac{1}{2}}{5}=\frac{9}{10}=9.=$*Ans.* or, $$\begin{array}{r|l} 12 & 6{\cdot} \\ 5 & 4{\cdot}5 \\ \hline & {\cdot}9=\text{Ans.} \end{array}$$

(13.) $$\begin{array}{r|l} 20 & 17 \\ 12 & 11{\cdot}85 \\ \hline & {\cdot}9875=\text{Ans.} \end{array}$$

(14.) $$\begin{array}{rr|l} 16 & \begin{cases}2\\8\end{cases} & \begin{array}{l}12{\cdot}\\ \ \ 6{\cdot}\end{array} \\ 16 & \begin{cases}2\\8\end{cases} & \begin{array}{l}\ \ \ \ {\cdot}75\\ \ \ \ \ {\cdot}375\end{array} \\ \hline & & {\cdot}046875=\text{Ans.} \end{array}$$

)15.) $$\begin{array}{r|l} 28 & 14{\cdot}0 \\ 4 & 2{\cdot}5 \\ \hline & {\cdot}625=\text{Ans.} \end{array}$$

(16.) $$\begin{array}{r|l} 40 & 4{\cdot} \\ 8 & 6{\cdot}1 \\ \hline & {\cdot}7625=\text{Ans.} \end{array}$$

(17.) $$\begin{array}{r|l} 2 & 1{\cdot}0 \\ 4 & 2{\cdot}5 \\ \hline & {\cdot}622=\text{Ans.} \end{array}$$

(18.) $$\begin{array}{r|l} 4 & 4{\cdot}0 \\ 63 & {\cdot}5 \\ \hline & {\cdot}071428+=\text{Ans.} \end{array}$$

(19.)
$$\begin{array}{r|l} 4 & 1\cdot0 \\ 36 & 2\cdot25 \\ \hline & \cdot0625 \end{array}$$
·0625=*Aus.*

(20.) $\frac{52}{365}$=·142465+=*A.*

(22.) ·9875 × 12 × 20=11*oz.* 17 *dwts.*=*Ans.*

(23.) ·046875 × 16 × 16 =12*dr.*=*Ans.*

(24.) ·625 × 4 × 28 = 2*qr.*14*lb.*=*Ans.*

(25.) ·625 × 4 × 2=2*qt.* 1*pt.*=*Ans.*

(26.) ·071428 × 63 × 4= 4 *gal.* 2 *qt.*=*Ans.*

(27.) ·0625 × 36 × 4=2 *gal.* 1 *qt.*=*Ans.*

(28.) ·142465 × 365 = 52 *days.*=*Ans.*

THE RULE OF THREE IN DECIMALS.

(2.) As 1 *m.* : 1·275*l.* : : 540 *m.* : 1·275 × 540=688·5 =688*l.* 10*s.*=*Ans.*

(3.) As 7·75*yds.* : 2·6375*l.* : : 140·5*yds.* : $\frac{2\cdot6375 \times 140\cdot5}{7\cdot75}$ =47·8153=47*l.* 16*s.* 3½*d.* ·15=*Ans.*

(4.) As 7·625 *cwt.* : 36·6375*l.* : : 2·4375 *cwt.* : $\frac{36\cdot6375 \times 2\cdot4375}{7\cdot625}$=11·71198*l.*=11*l.* 14*s.* 2¾*d.* ·5=*Ans.*

(5.) First 24 *tons*, 12 *cwt.* 2*qrs.* 14*lb.* 12*oz.*=882796*oz.* hen we have, as 882796 oz. : 3678·316′*l.* : : 1*oz.* : $\frac{3678\cdot316'}{882796}$=·00416′*l.*=1*d.*=*Ans.*

(6.) As 1·5 *lb.* : 3·5*s.* : : 326·25 *lb.* : $\frac{326\cdot25 \times 3\cdot5}{1\cdot5}$=761 ·5*s.*=38*l.* 1*s.* 3*d.*=*Ans.*

(7.) As 480*gr.* : 2·951*l.* : : 9197*gr.* : $\frac{9197 \times 2\cdot95}{480}$ = 56·5232*l.*=56*l.* 10*s.* 5½*d.*+=*Ans.*

(8.) As 1 *yd.* : 10·5*d.* : : 827·75 *yds.* : 827·75 × 10·5 = 8691 375*d.*=36*l.* 4*s.* 3½*d.* ·35=*Ans.*

(9.) As 625*yr.* : 34*l.* : : 416*yr.* : $\frac{34 \times 625}{\cdot416}$=51*l.*=*Ans.*

(10.) As 1·075*l.* : 3·5 *yds.* : : 32·775*l.* : $\frac{32\cdot775 \times 3\cdot5}{1\cdot075}$= *106 yds. 2 qrs.* 3 *n.*=*Ans.*

(11.) **As** ·480 *gr.* : 5·5*s.* :: 10804 *gr.* : $\frac{10804 \times 5{\cdot}5}{480}$ = 123·7958*s.*=6*l.* 3*s.* 9½*d.* ·198=*Ans.*

(12.) **As** 1*lb.* : 1·25*s.* :: 1727 *lb.* : 1727 × 1·25 =2158·75*s.*=107*l.* 18*s.* 9*d.*=*Ans.*

(13.) **As** 112*lb.* : 2·475*l.* :: 5138*lb.* : $\frac{5138 \times 2{\cdot}478}{112}$ = 113·540625*l.*=113*l.* 10*s.* 9¾*d.*=*Ans.*

(14.) As 1 *cwt.* : 2·8*l.* :: 40·5 *cwt.* : 40·5 × 2·8=113·4*l.* =113*l.* 8*s.*=*Ans.*

(15.) As 5·3′*s.* : 1*oz.* :: 212*s.* : $\frac{212}{5{\cdot}3'}$ =39*oz.* 15*dwt.*=*An.*

(16.) As 2898 *lb.* : 187·1625*l.* :: 1 *lb.* : $\frac{187{\cdot}1625}{2898}$= ·064583′=15½*d*=*Ans.*

(17.) As 29·25 *lb.* : 10·5625*l.* :: 3 *lb.* : $\frac{10{\cdot}5625 \times 3}{29{\cdot}25}$= 1·083′=1*l.* 1*s.* 8*d.*=*Ans.*

(18.) As 3·5*lb.* : 1·083′*s.* :: 112*lb.* : $\frac{1{\cdot}083' \times 112}{3{\cdot}5}$=34·6′*s.* =1*l.* 14*s.* 8*d.*=*Ans.*

EXTRACTION OF THE SQUARE ROOT.

(2.)

$$\begin{array}{r l}
 & 10|69|29(327=\textit{Ans.} \\
 & 9 \\
62) & \overline{169} \\
 & 124 \\
647) & \overline{4529} \\
 & 4529 \\
 & \overline{\cdots\cdots} \\
\end{array}$$

(3.) 2|26|87|41 1506·23 *Ans.*
1
25)126
125
3006) 18741
18036
30122) 70500
60244
301243)1025600
903729
·121871

(4.) 7|59|67|96(2756·228 *A.*
4
47)359
329
545) 3067
2725
5506) 34296
33036
55122) 126000
110244
551242) 1575600
1102484
5512448) 47311600
44099584
·3212016

(5.) 36|37|2961(6031 *Ans.*
36
1203) 3729
3609
12061) 12061
.....

(6.) 22|07|12|04(4698 *Ans.*
16
86) 607
516
929) 9112
8361
9388) 75104
75104
......

(7.) 32|71|·42|07|(57·19 *Ans.*
25
107) 771
749
1141) 2242
1141
11429)110107
102861
··7246

(8.) 47|95|·25|73|10(69·247 *Ans.*
36
129)1195
1161
1382) 3425
2764
13844) 66173
55376
138487)1079710
969409
·110301

(9.) 4|·37|25|94(2·091 *Ans.*
4
409) 3725
3681
4181) 4494
4181
·313

(10.) 2|·27|10|95|70(1·50701 *Ans.*
1
25)127
125
3007) 21095
21049
301401) 467000
301401
165599

(11.) ·00|03|27|54(·01809 *A.*
1
28)227
224
3609) 35400
32481
·2919

(12.) 1|·27|00|54(1·1269 *Ans.*
1
21) 27
21
222) 600
444
2246)15654
13476
22529) 217800
202761
·15039

TO EXTRACT THE SQUARE ROOT OF A VULGAR FRACTION.

(13.) $\frac{2304}{5184}=\frac{192}{432}=\frac{16}{36}=\frac{4}{9}$;
and $\sqrt{\frac{4}{9}}=\frac{2}{3}=$ *Ans.*

(14.) $\frac{2704}{4225}=\frac{16}{25}$; and $\sqrt{\frac{16}{25}}=\frac{4}{5}=$ *Ans.*

(15.) $\frac{9216}{12544}=\frac{36}{49}$; and $\sqrt{\frac{36}{49}}=\frac{6}{7}=$ *Ans.*

(16.) Here $\frac{275}{341}=\frac{25}{31}=$·8064516129
and $\sqrt{}$·8064516129=·89802+= *Ans.*

Or, $\sqrt{\frac{275}{341}}=\frac{1}{341}\sqrt{(275\times341)}=\frac{1}{341}\sqrt{93775}=\frac{1}{341}\times$
$306\cdot227+=\cdot89802+=$*Ans.*

(17.) Here $\sqrt{\frac{357}{476}}=\frac{1}{476}\sqrt{(357\times476)}=\frac{1}{476}\sqrt{169932}=$
$\frac{1}{476}\times412\cdot22808+=\cdot86602+=$*Ans.*

(18.) Here $\sqrt{\frac{478}{549}}=\frac{1}{549}\sqrt{(478\times549)}=\frac{1}{549}\sqrt{262422}$
$=\frac{1}{549}\sqrt{(9\times29158)}=\frac{1}{549}\sqrt{(3^2\times29158)}=$
$\frac{3}{549}\sqrt{29158}=\frac{\sqrt{29158}}{183}=\frac{170\cdot75713+}{183}=$
$\cdot93309+=$*Ans.*

(19.) Here $\sqrt{51\frac{21}{25}}\sqrt{\frac{1296}{25}}=\frac{36}{5}=7\frac{1}{5}=$*Ans.*

(20.) Here $\sqrt{27\frac{9}{16}}=\sqrt{\frac{441}{16}}=\frac{21}{4}=5\frac{1}{4}=$*Ans.*

(21.) Here $\sqrt{9\frac{43}{49}}\sqrt{\frac{484}{49}}=\frac{22}{7}=3\frac{1}{7}=$*Ans.*

(22.) $\sqrt{85\frac{14}{15}}=\sqrt{85\cdot93'}=9\cdot27+=$*Ans.*

or; $\sqrt{85\frac{14}{15}}=\sqrt{\frac{1289}{15}}=\frac{1}{15}\sqrt{(1289\times15)}=\frac{1}{15}\sqrt{}$
$193635=\frac{139\cdot05+}{15}=9\cdot27+=$*Ans.*

(23.) Here $\sqrt{8\frac{5}{7}}=\frac{61}{7}=\frac{1}{7}\sqrt{(61\times7)}=\frac{\sqrt{427}}{7}=\frac{20\cdot6639+}{7}$
$=2\cdot9519+=$*Ans.*

(24.) Here $\sqrt{6\frac{2}{5}}=\sqrt{\frac{32}{5}}=\frac{1}{5}\sqrt{(32\times5)}=\frac{\sqrt{160}}{5}=$
$\frac{12\cdot6491+}{5}=2\cdot5298+=$*Ans.*

THE APPLICATION.

(1.) Here $576^2=576\times576=331776=$*Ans.*

(2.) Here $97^2=97\times97=9409=$*Ans.*

To find a mean Proportional between any Two given Numbers.

(4.) Here $\sqrt{(4276\times842)}=\sqrt{3600392}=1897{\cdot}4+=A.$

To find the side of a Square equal in Area to any given Superficies.

(5.) Here $\sqrt{160}=12{\cdot}649+=$*Ans.*

(6.) Here $\sqrt{750}=27{\cdot}38612+=$*Ans.*

The Area of a Circle being given to find the Diameter.

(7.) Here $\sqrt{1}$ *sq. acre* $=\sqrt{160}$ *sq. perches* $=12{\cdot}649+$ *perches* and $1{\cdot}12838\times(12{\cdot}649+)$ *perches*$=14{\cdot}272$ *perches*$=$ *diameter of the cow's circular range, and half of which* $-5\frac{1}{2}$ *yards*$=[(7{\cdot}136+)-1]$ *perches* $=6{\cdot}136+$*perches*$=$*length of the cord required.*

The Area of a Circle being given, to find the Periphery or Circumference.

(8.) Here as $1:12{\cdot}56637::12$ *the area* $:150{\cdot}79644$ the square of the periphery.

Hence $\sqrt{150{\cdot}79644}=12{\cdot}2799+=$*Ans.*

(9.) Here $3{\cdot}5449\times\sqrt{160}=3{\cdot}5449\times12{\cdot}649+=44{\cdot}839+=$*Ans.*

(10.) $\sqrt{60^2\times45^2}=\sqrt{3600\times2025}=\sqrt{5625}=75$ *yds*$=A.$

(11.) $\sqrt{(33^2\times25^2)}=\sqrt{(900+625)}=\sqrt{1525}=39{\cdot}05+$ *feet.*$=$*Ans.*

Any number of Men being given, to form them into a Square Battalion, or to find the number of Rank and File.

(12.) Here $\sqrt{331776}=576=$*Ans.*

(13.) Here $\sqrt{48841}=221=$*Ans.*

EXTRACTION OF THE CUBE ROOT.

Alexander Ingram's Method.

(2.) $389|017(73$

$7^3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots=343$

Trial divisor$=3\times7^2=3\times49=147$ $\quad 46017$

$213\times3 \;\ldots\ldots= \;639$

True divisor $\ldots\ldots\ldots\ldots=15339\times3=46017$

$\cdots\cdot$

(3.) 5|735|339(179=*Ans.*

1^3........=1

Trial divisor=3×1^2=3 4735

37×7=259

True divisor......=559 × 7=3913

7^2= 49 822339

Trial divisor.... =867

519×9= 4671

True divisor......=91371 × 9=822339

......

(4.) 32|461|759(319=*Ans.*

3^3=27

Trial divisor=3×3^2=27 5461

91×1= 91

True divisor......=2791 × 1= 2791

1^2= 1 2670759

Trial divisor......=2883

939×9= 8451

True divisor......=296751 × 9= 2670759

....

(5.) 84|604|519(439=*A.*

4^3=64

Trial divisor..=$4^2\times3$=48 20604

123×3= 369

True divisor........=5169 × 3 =15507

3^2= 9 5097519

Trial divisor........=5547

1299×9= 11691

True divisor........=566391 × 9=5097519

....

(6.) ^{3}259|694|072(638=*A*

$6^3 = 216$

Trial divisor $= 6^2 \times 3 = 108$ 43694

$183 \times 3 = 549$

True divisor...... $= 11349 \times 3 .. = 34047$

$3^2 = 9$ 9647072

Trial divisor...... $= 11907$

$1898 \times 8 = 15184$

True divisor...... $= 1205884 \times 8 = 9647072$

......

(7.) ^{3}48|228|544(364=*Ans.*

$3^3 = 27$

Trial divisor.. $= 3^2 \times 3 = 27$ 21228

$96 \times 6 = 576$

True divisor......... $= 3276 \times 6 = 19656$

$6^2 = 36$ 1572544

Trial divisor......... $= 3888$

$1084 \times 4 = 4336$

True divisor........ $= 393136 \times 4 = 1572544$

....

(8.) ^{2}27|054|036 008(3002=*Ans.*

$3^2 = 27$

Trial divisor $= 3^2 \times 3 = 27$ 54036008

$9002 \times 2 = 018004$

True divisor .... $= 27018004 \times 2 = 54036008$

....

(9.) 22|069|810|125(2805=*A.*

$2^3 = 8$

14069

Trial di.$=2^2\times3=12$

$68\times8=544$

True divisor ..$=1744\times8$.. $=13952$

117810125

$8^2=64$

Trial divisor.. $=2352$

$8405\times5=42025$

True divisor.. $=23562025\times5=117810125$

....

(10.) 122|615|327|232(4968=*A.*

$4^3 = 64$

58615

Trial div.$=4^2\times3=48$

$120\times9=1161$

True divisor ....$=5961\times9$..$=53649$

4966327

$9^2=81$

Trial divisor....$=7203$

$1476\times6=8856$

True divisor....$=729156\times6=4374936$

591391232

$6^2=36$

Trial divisor ..$=738048$

$14888\times8=119104$

True divisor ..$=73923904\times8=591391232$

....

(11.) 219|365|327|791(6031=*A.*

$6^3=216$

3365327

Trial di.$=6^2\times3=108$

$1803\times3=5409$

True divisor ..$=1085409\times3=3256227$

109100791

$3^2=9$

Trial divisor ..$=1090827$

$18091\times1=18091$

True divisor ..$=109100791\times1=109100791$

....

(12.) ^{3} 673|373|097|125(8765=*A.*

$8^3=512$

Trial di.=$8^2\times3=192$ 161373

$247\times7=$ 1729

True divisor ..=20929×7 =146503

$7^2=$ 49 14870097

Trial divisor ..=22707

$2616\times6=$ 15696

True divisor ..=2286396×6=13718376

$6^2=$ 36 1151721125

Trial divisor . =2302128

$26285\times5=$ 131425

True divisor ..=230344225×5=1151721125

....

(13.) ^{3} 12·|977|875(2·35=*Ans.*

$2^3=$ 8

Trial divisor=$2^2\times3=12$ 4977

$63\times3=$ 189

True divisor ......=1389×3 = 4167

$3^2=$ 9 810875

Trial divisor......=1587

$695\times5=$ 3475

True divisor......=162175×5 = 810875

......

(14.) 36|155|·027|576(33·06+=*A.*

$3^2=27$

Trial di.=$3^2\times3=27$ 9155

$93\times3=$ 279

True divisor.. =2979×3 =8937

$3^2=$ 9 218027576

Trial divisor.. =3267

$9906\times6=$ 59436

True divisor .. =32729436×6=196376616

·21650960

(15.) $\cdot001|906|624(\cdot124 = A.$

$1^3 =$ 1

Trial divisor $1^2 \times 3 = 3$ 906

$32 \times 2 = 64$

True divisor ....$= 364 \times 2$ ....$=$ 728

$2^2 = 4$ 178624

Trial divisor ....$= 432$

$364 \times 4 = 1456$

True divisor ....$= 44656 \times 4$ ..$=$ 178624

......

(16.) Here $\sqrt[3]{\frac{250}{686}} = \sqrt[3]{\frac{125}{343}} = \frac{\sqrt[3]{125}}{\sqrt[3]{343}} = \frac{5}{7} =$ *Ans.*

(17.) Here $\sqrt[3]{\frac{324}{1500}} = \sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{3}{5} =$ *Ans.*

(18.) Here $\sqrt[3]{\frac{1520}{5130}} = \sqrt[3]{\frac{8}{27}} = \frac{\sqrt[3]{8}}{\sqrt[3]{27}} = \frac{2}{3} =$ *Ans.*

(19.) Here $\sqrt[3]{12\frac{19}{27}} = \sqrt[3]{\frac{343}{27}} = \frac{\sqrt[3]{343}}{\sqrt[3]{27}} = \frac{7}{3} = 2\frac{1}{3} =$ *Ans*

(20.) Here $\sqrt[3]{31\frac{15}{343}} = \sqrt[3]{\frac{10648}{343}} = \frac{\sqrt[3]{10648}}{\sqrt[3]{343}} = \frac{22}{7} = 3\frac{1}{7}$ *A.*

(21.) Here $\sqrt[3]{405\frac{28}{125}} = \sqrt[3]{\frac{50653}{125}} = \frac{\sqrt[3]{50653}}{\sqrt[3]{125}} = \frac{37}{5} = 7\frac{2}{5}$
$=$ *Ans.*

THE APPLICATION.

(1.) Here $47^3 = 47 \times 47 \times 47 = 103823$ *cub. in.* $=$ *Ans.*
(2.) Here $12^3 = 12 \times 12 \times 12 = 1728$ *cub. ft.* $=$ *Ans.*
(3.) Here $(\sqrt[3]{389017})^2 = 73^2 = 5329$ *sq. ft.* $=$ *Ans.*

Between two given Numbers to find two mean Proportionals.

(4.) First $162 \div 6 = 27$; then $\sqrt[3]{27} = 3$
Hence $6 \times 3 = 18 = 1$*st Ans.* And $18 \times 3 = 54 =$
2*nd Ans.*

(5.) First $108 \div 4 = 27$; then $\sqrt[3]{27} = 3$
Hence $4 \times 3 = 12 = 1$*st Ans.* And $12 \times 3 = 36 =$
2*nd Ans.*

To find the Side of a Cube that shall be equal in Solidity to any given Solid, as a Globe, Cylinder, Prism, Cone, &c.

(6.) Here $\sqrt[3]{10648}=22=$ *Ans.*

The Side of a Cube being given to find the Side of the Cube that shall be double, triple, &c. in capacity to the Cube given.

(7.) Here $\sqrt[3]{(3\times12^3)}=\sqrt[3]{(3\times1728)}=\sqrt[3]{5184}=17{\cdot}307$ *in.*$=$ *Ans.*

EXTRACTION OF THE BIQUADRATE ROOT.

(1.) Here $27^4=(27^2)^2=729^2=531441=$ *Ans.*
(2.) Here $76^4=(76^2)^2=5776^2=33362176=$ *Ans.*
(3.) Here $275^4=(275^2)^2=75625^2=5719140625=A.$
(4.) Here $\sqrt[4]{531441}=\sqrt{(\sqrt{531441})}=\sqrt{729}=27=A.$
(5.) Here $\sqrt[4]{33362176}=\sqrt{(\sqrt{33362176})}=\sqrt{5776}=76=$ *Ans.*
(6.) Here $\sqrt[4]{5719140625}=\sqrt{(\sqrt{5719140625})}=\sqrt{75625}=275=$ *Ans.*

SIMPLE INTEREST.

The Principal, Rate, and Time given, to find the Interest.

I. When p, r, and t, are given to find i.

FORMULA I. $i=p\ r\ t$.

(2.) Here $p=547l.\ 14s.=547{\cdot}7l.$: $r={\cdot}04$; and $t=6$.
Hence $i=p\ r\ t=547{\cdot}7l.\times{\cdot}04\times6=131{\cdot}448l.=131l.\ 8s.\ 11d.\ 2{\cdot}08\ q.=$ *Ans.*

(3.) Here $p=796l.\ 15s.=796{\cdot}75l.$; $r={\cdot}045$: and $t=5$
Hence $i=p\ r\ t=796{\cdot}75l.\times{\cdot}045\times5=179l.\ 5s.\ 4\tfrac{1}{2}d.$
[p=principal, t=number of years and parts in the time, $r:1::$interest of p, when $p=1:p$ when $p=1$.]

(4.) Here $p=397l.\ 9s.\ 5d.=397{\cdot}470833l.$; $r={\cdot}035$; and $t=2\tfrac{1}{2}=2{\cdot}5$.
Hence $i=p\ r\ t=397{\cdot}470833l.\times{\cdot}035\times2{\cdot}5=34{\cdot}778698l.=34l.\ 15s.\ 6d.\ 3{\cdot}5499q.=$ *Ans.*

(5.) Here $p=554l.\ 17s\ 6d.=554{\cdot}875$; $r={\cdot}045$ and $t=3{\cdot}5$.

Hence $i=p\,r\,t=554{\cdot}875\times 045\times 3{\cdot}5=87{\cdot}3928125$ $=87l.\ 7s.\ 10d.\ 1,\ 1\ qr.=$ *Ans.*

(6.) Here $236l.\ 18s.\ 9d.=236l{\cdot}9375$; $t=3{\cdot}75$; and $r={\cdot}055$.

$\therefore\ 236{\cdot}9375\times{\cdot}055\times 3{\cdot}75=48l.\ 17s.\ 4d.\ 1{\cdot}625q.$

(8.) Here $563l.\times 126\times{\cdot}00016438356=11l.\ 660856=11l.\ 13s.\ 2\tfrac{1}{2}d+=$ *Ans.*

(9.) Here $560l\times 60\times{\cdot}0001369863=4{\cdot}602+=4l.\ 12s.\ 0\tfrac{1}{2}d.+=$ *Ans.*

(10.) Here $364{\cdot}9\times 154\times 0001369863=7{\cdot}697+=7l.\ 13s.\ 11\tfrac{1}{4}d.+=$ *Ans.*

(11.) Here $725{\cdot}75\times 74\times 00010958904=5{\cdot}885+=5l.\ 17s.\ 8\tfrac{1}{2}d.+=$ *Ans.*

(12.) Here $100\times 281\times 0001369863=01369863\times 281=3{\cdot}84933+=3l.\ 16s.\ 11\tfrac{3}{4}d.+=$ *Ans.*

II. When p, r, and t, are given to find a.

FORMULA II. $a=p\,r\,t+p$.

(14.) Here $p=320l.\ 17s.=320{\cdot}85l.$; $r={\cdot}035$; and $t=5$.

Hence $a=p\,r\,t+p=320{\cdot}85l.\times{\cdot}035\times 5+320{\cdot}85l.$ $=56{\cdot}14875l.+32085l.=376{\cdot}99875l.=376l.\ 19s.\ 11d.\ 2\ 8\ q.=$ *Ans.*

(15.) Here $p=679l.\ 13s.=679{\cdot}65l.$; $r={\cdot}05$; and $t=6$.

Hence $a=p\,r\,t+p=679{\cdot}65l.\times{\cdot}05\times 6+679{\cdot}65l.$ $=203{\cdot}895l{\cdot}+679{\cdot}65l.=883{\cdot}545l.=883l.\ 10s.\ 10d.\ 3{\cdot}2q.=$ *Ans.*

(16.) Here $p=926l.\ 12s.=926{\cdot}6l.$; $r={\cdot}04$; and $t=5\tfrac{1}{2}=5{\cdot}5$.

Hence $a=p\,r\,t+p=926{\cdot}6l.\times{\cdot}04\times 5{\cdot}5+926{\cdot}6l.$ $=1130{\cdot}452l.=1130l.\ 9s.\ 0d.\ 1{\cdot}92q.=$ *Ans.*

(17.) Here $p=368{\cdot}8l.$; $r={\cdot}065$; and $t=7{\cdot}75$.

Hence $a=p\,r\,t+p=368{\cdot}8l.\times{\cdot}065\times 7{\cdot}75+368{\cdot}8l.$ $=554{\cdot}583l.=554l.\ 11s\ 7d.\ 3{\cdot}68q.=$ *Ans.*

(18.) Here $p=273{\cdot}9$; $r={\cdot}03$; and the days in the decimal of a year may be found by *Int. Table page* 170. *Arith.*$=\ {\cdot}479452,\therefore t=4{\cdot}479452$.

Hence $a=p\,r\,t+p=273{\cdot}9l.\times{\cdot}03\times 4{\cdot}479452+273{\cdot}9l.$ $=310.7076570844l.=310l.\ 14s.\ 1d.\ 3{\cdot}35080064q.=$ *Ans.*

III. When a, r. and t are given to find p.

$$\text{Formula III. } p=\frac{a}{rt.+1}$$

(20.) Here $a=376l.\ 19s.\ 11d.\ 2{\cdot}8q.=376{\cdot}99875l.$; $r={\cdot}035$; and $t=5$.

Hence $p=\dfrac{a}{rt+1}=\dfrac{376{\cdot}99875l.}{{\cdot}035\times5+1}=\dfrac{376{\cdot}99875l.}{1{\cdot}175}=$ $320{\cdot}85l.=320l.\ 17s.=$*Ans.*

(21.) Here $p=\dfrac{a}{rt+1}=\dfrac{883{\cdot}545l.}{{\cdot}05\times6+1}=\dfrac{883{\cdot}545l.}{1{\cdot}3}=$ $679{\cdot}65l.=679l.\ 13s.=$*Ans.*

(22.) Here $p=\dfrac{a}{rt+1}=\dfrac{1130{\cdot}452l.}{{\cdot}04\times5{\cdot}5+1}=\dfrac{1130{\cdot}452l.}{1{\cdot}22}=$ $926{\cdot}6l.=926l.\ 12s.=$*Ans.*

(23.) Here $p=\dfrac{a}{rt+1}=\dfrac{554{\cdot}583l.}{{\cdot}065\times7{\cdot}75+1}=\dfrac{554{\cdot}583l.}{1{\cdot}50375}=$ $368{\cdot}8l.=368l.\ 16s.=$*Ans.*

(24.) Here $p=\dfrac{a}{rt+1}=\dfrac{310{\cdot}707657084l.}{{\cdot}03\times4{\cdot}479452+1}=$ $\dfrac{310{\cdot}707657084}{1{\cdot}13438356}=273{\cdot}9l.=273l.\ 18s.=$*Ans.*

IV. When a, p, and t are given to find r,

$$\text{Formula IV. } r=\frac{a-p}{pt}.$$

(26.) Here $r=\dfrac{a-p}{p\,t}=\dfrac{376{\cdot}99875-320{\cdot}85}{320{\cdot}85\times5}\quad\dfrac{56{\cdot}14875}{1604{\cdot}25}$ $={\cdot}035$; hence $3\frac{1}{2}$ *per cent.*$=$*Ans.*

(27.) Here $r=\dfrac{a-p}{p\,t}=\dfrac{883{\cdot}545-679{\cdot}65}{679{\cdot}65\times6}=\dfrac{203{\cdot}895}{4077{\cdot}9}=$ ${\cdot}05$, or 5 *per cent.*$=$*Ans.*

(28.) Here $r=\dfrac{a-p}{p\,t}=\dfrac{1130{\cdot}452-926{\cdot}6}{926{\cdot}6\times5{\cdot}5}=\dfrac{203{\cdot}852}{5096{\cdot}3}=$ ${\cdot}04$, or 4 *per cent.*$=$*Ans.*

(29.) Here $r=\frac{a-p}{pt}=\frac{554{\cdot}583—368{\cdot}8}{368{\cdot}8\times7{\cdot}75}=\frac{185{\cdot}783}{2858{\cdot}2}=$ ·065, or 6½ *per cent.=Ans.*

(30:) Here $r=\frac{r—p}{pt}=\frac{310{\cdot}707657084=273{\cdot}9}{273{\cdot}9\times4{\cdot}479452}=$ $\frac{36{\cdot}807657084}{1226{\cdot}9219028}=$·03, or 3 *per cent.=Ans.*

V. When a, p, and r are given to find t.

FORMULA V. $t=\frac{a—p}{p\,r}$.

(32.) Here t *years*$=\frac{a—p}{p\,r}$*years* $=\frac{376{\cdot}99875—320{\cdot}85}{320{\cdot}85\times{\cdot}035}$ *years* $=\frac{56{\cdot}14875}{11{\cdot}22975}$*years*=5 *years=Ans.*

(33.) Here t *years*$=\frac{a—p}{p\,r}$*years*$=\frac{883{\cdot}545—679{\cdot}65}{679{\cdot}65\times{\cdot}05}$ *years* $=\frac{203{\cdot}895}{33{\cdot}9825}$*years*=6 *years.=Ans.*

(34.) Here t *years*$=\frac{a—p}{p\,r}$*years*$=\frac{1130{\cdot}452—9266}{926{\cdot}6\times{\cdot}04}$ *years* $=\frac{203{\cdot}852}{37{\cdot}064}$*years*=5·5 or 5½ *years=Ans.*

(35.) Here t *years* $=\frac{a—p}{p\,r}$*years*$=\frac{554{\cdot}583—368{\cdot}8}{368{\cdot}8\times.065}$*yrs.*$=$ $\frac{185{\cdot}783}{23{\cdot}792}$*years*=7·75, or 7¾ *years=Ans.*

(36.) Here t *years*$=\frac{a—p}{p\,r}$*years*$=\frac{310{\cdot}707657084—273{\cdot}9}{273{\cdot}9\times{\cdot}03}$ *years*$=\frac{36{\cdot}807657084}{8{\cdot}217}$*years*=4·479452 *years*=4 *years* 175 *days=Ans.*

ANNUITIES OR PENSIONS, &c., IN ARREARS.

I. When u, r, t, are given to find a.

FORMULA I. $\frac{ttu-tu}{2}\times r : \times tu=a$.

(38.) Here $\overline{7\times7\times250}-\overline{7\times250}=10500$.

then $\frac{10500}{2}\times{\cdot}06+\overline{7\times250}=£2065=$ *Ans.*

(39.) Here $\overline{5{\cdot}5\times5{\cdot}5\times60}-\overline{5{\cdot}5\times60}=1485$;

then $\frac{1485}{2}\times{\cdot}045+\overline{5{\cdot}5\times60}=£363{\cdot}4125=£363\ \ 8\ \ 3$

(40.) Here $8\times8\times28-8\times28=1568=$ *Ans.*

and $\frac{1568}{2}\times{\cdot}05+\overline{8\times28}=£263{\cdot}2=£263$ 4*s.*$=$ *Ans.*

(41.) Here (by Note after Ex. 40,) $\overline{10\times10\times75}-\overline{10\times75}=6750$; and $\frac{6750}{2}\times{\cdot}025+(10\times75)=£834{\cdot}375=£834$ 7*s.* 6*d.*$=$ *Ans.*

(42.) Here $\overline{20\times20\times37{\cdot}5}-\overline{20\times37{\cdot}5}=14250$

and $\frac{14250}{2}\times{\cdot}0125+\overline{20\times37{\cdot}5}=£839{\cdot}0625=£839$ 1*s.* 3*d.*$=$ *Ans.*

II. When a, r, and t are given to find u.

FORMULA II. $\frac{2\,a.}{\overline{ttr}-\overline{tr+2t}}=u$.

(44.) Here $363{\cdot}4125\times2=726{\cdot}825$.

and $\overline{5{\cdot}5\times5{\cdot}5\times{\cdot}045}-\overline{5{\cdot}5\times{\cdot}045}+\overline{5{\cdot}5\times2}=12{\cdot}11375$.
therefore $726{\cdot}825\div12{\cdot}11375=£60.=$ *Ans.*

(45.) Here $\frac{2065\times2}{(7\times7\times{\cdot}06)-(7\times{\cdot}06)+(7\times2)}=£250=$ *A.*

(46.) Here by the Formula we have.

$$u=\frac{263{\cdot}2\times2}{(8\times8\times{\cdot}05)-(8\times{\cdot}05)+(2\times8)}=£28.=\textit{Ans.}$$

(47.) Here (*see the Note after Ex.* 46.)
$834\cdot375\times4=3337\cdot5$
and $(10\times10\times\cdot025)-(10\times\cdot025)+(10\times2)=22\cdot25$
$\therefore 3337\cdot5\div22\cdot25=£150=$*Ans.*

(48.) Here $839\cdot0625\times8=6712\cdot5$.
and $(20\times20\times0125)-(20\times\cdot0125)+(20\times2)=44\cdot75$
$\therefore 6712\cdot5\div44\cdot75=£150=$*Ans*

III. When *u*, *a*, and *t* are given to find *r*.

FORMULA III. $\frac{2a-2ut}{utt-ut}=r$.

(50.) Here $r=\frac{2a-2ut}{utt-ut}=\frac{2(a-ut)}{ut(t-1)}$.

Hence $\frac{(363\cdot4125-330)\times2}{330\times(5\cdot5-1}=\frac{2\times33\cdot4125}{330\times4\cdot5}=\frac{66\cdot825}{1485}$
$=\cdot045$. or 4½ *per cent.*=*Ans.*

(51.) Here $ut=250\times7=1750$.

Hence $r=\frac{2\times(2065-1750)}{1750\times(7-1)}=\frac{2\times315}{1750\times6}=\frac{630}{10500}=\cdot06$
or 6 *per cent.*=*Ans.*

(52.) Here $ut=28\times8=224$.

Hence $r=\frac{2\times(2632-224)}{224\times(8-1)}=\frac{2\times39\cdot2}{224\times7}=\frac{78\cdot4}{1568}=\cdot05$, or
5 *per cent*=*Ans.*

(53.) Here (*see the Note after Ex.* 52.) $4a-4ut=$ $(4\times834\cdot375)-(4\times150\times5)=3337\cdot5-3000=337\cdot5=$dividend; and $\frac{u}{2}\times2t\times(2t-1)=ut(2t-1)=150\times5\times(10-1)$ $=150\times5\times9=6750=$*divisor*;

Hence $r=\frac{337\cdot5}{6750}=\cdot05$, or 5 *per cent.*=*Ans.*

(54.) Here (*see the Note after Ex.* 52.) $8a-8ut$ will be the dividend, and ut $(4t-1)$ the divisor.

Then dividend$=(8\times839\cdot0625)-(8\times150\times5)=6712\cdot5$ $-6000=712\cdot5$; and divisor$=150\times5\times(20-1)=750\times19$ $=14250$;

Hence $r=\frac{712\cdot5}{14250}=\cdot05$, or 5 *per cent.*=*Ans.*

IV. When u, a, and r, are given to find t.

Formula IV. First $\frac{2}{r}-1=x$: then $\sqrt{\frac{2a}{ur}+\frac{x^2}{4}}-\frac{x}{2}=t$.

(56.) Here $x=\frac{2}{\cdot05}-1=39.\ \frac{263\cdot2\times2}{28\times\cdot05}=376$,

and $\frac{39\times39}{4}=380\cdot25$ then $t=\sqrt{376+380.}-\frac{39}{2}=$ 3 (*years.*)=*Ans.*

(57.) Here $x=\frac{2}{\cdot025}-1=79\cdot\frac{834\cdot375\times2}{\cdot025\times75}=890$

and $\frac{72\times79}{4}=1560\cdot25$: therefore $t=\sqrt{(890+1560\cdot25)}-\frac{79}{2}=\sqrt{2450\cdot25}-39\cdot5=49\cdot5-39\cdot5=10$ (*half-years*) or 5 *years.*=*Ans.*

(58.) Here $x=\frac{2}{\cdot0125}-1=159.$

$\frac{839\cdot0625\times2}{37\cdot5\times\cdot0125}=3580$, and $\frac{159\times159}{4}=6320\cdot25.\therefore t=\sqrt{(3580+6320\cdot25)}-\frac{159}{2}=\sqrt{9900\cdot25}-\frac{159}{2}=99\cdot5-79\cdot5=20$ (*quarters,*) or 5 *years.*=*Ans.*

PRESENT WORTH OF ANNUITIES.

I. When u, t, and r are given to find p.

Formula I. $\frac{t\,t\,r-t\,r+2\,t}{2\,t\,r+2}:\times u=p.$

(60.) Here $\overline{5\cdot5\times5\cdot5\times\cdot045}-\overline{5\cdot5\times\cdot045}+\overline{5\cdot5\times2}=12\cdot11375.$

and $\overline{5\cdot5\times\cdot045\times2}+2=2\cdot495.$

$\therefore p=\frac{12\cdot11375}{2\cdot495}\times60=291\cdot3125=$ £291 6 : 3 : *Ans.*

(61.) Here $\overline{7\times7\times\cdot06}-\overline{7\times\cdot06}+\overline{7\times2}=16\cdot52$
and $\overline{7\times\cdot06\times2}+2=2\cdot84$

$\therefore p=\frac{16\cdot52}{2\cdot84}\times250=1454\cdot225=£1454\ 4\ 6=$*Ans.*

(62.) Here $\overline{8\times8\times\cdot05}-\overline{8\times\cdot05}+\overline{8\times2}=18\cdot8.$
and $\overline{8\times\cdot05\times2}+2=2\cdot8$

$\therefore p=\frac{18\cdot8}{2\cdot8}\times28=£188=$*Ans.*

(63.) Here (*see Note after Ex.* 62) $\overline{10\times10\times\cdot025}-\overline{10\times\cdot025}+\overline{10\times2}=22\cdot25$ and $\overline{10\times025\times2}+2=2\cdot5$

$\therefore p=\frac{22\cdot25}{2\cdot5}\times75=667.5=£667\ 10=$*Ans.*

(64.) Here $\overline{20\times20\times\cdot0125}-\overline{20\times\cdot0125}+\overline{20\times2}=44\cdot75$
and $\overline{20\times\cdot0125\times2}+2=2\cdot5$

$\therefore p=\frac{44\cdot75}{2\cdot5}\times37\cdot5=671\cdot25=£671\ 5=$*Ans.*

II. When p, t, and r are given to find u.

FORMULA II. $\frac{t\,r+1}{t\,t\,r-t\,r+2\,t}:\times2\,p=u.$

(66.) Here $t\,r+1=\overline{5\cdot5\times\cdot045}+1=1\cdot2475$
and $t\,t\,r-t\,r+2\,t=\overline{5\cdot5\times5\cdot5\times\cdot045}-\overline{5\cdot5\times\cdot045}+11$
$=12\cdot11375.\therefore u=\frac{1\cdot2475}{12\cdot11375}\times291\cdot3125\times2=£60.=$*Ans.*

(67.) Here $\overline{7\times\cdot06}+1=1\cdot42$; and $\overline{7\times7\times\cdot06}-\overline{7\times\cdot06}+14=16\cdot52.$

$\therefore u=\frac{1\cdot42}{16\cdot52}\times1454\cdot225\times2=£250.=$*Ans.*

(68.) Here $\overline{8+\cdot05}+1=1\cdot4$; and $\overline{8\times8\times\cdot05}-\overline{8\times\cdot05}+16=18\cdot8.$

$\therefore u=\frac{1\cdot4}{18\cdot8}\times188\times2=£28.=$*Ans.*

(69.) Here (*see Note after Ex.* 68) $\overline{10\times\cdot025}+1=1\cdot25$ and $\overline{10\times10\times\cdot025}-\overline{10\times\cdot025}+20=22\cdot25$.

$$\therefore\ u=\frac{1\cdot25}{22\cdot25}\times667\cdot5\times4=£150.=\textit{Ans.}$$

(70.) Here $\overline{20\times\cdot0125}+1=1\cdot25$; and $\overline{20\times20\times\cdot01}-\overline{20\times\cdot0125}+40=44\cdot75$.

$$\therefore\ u=\frac{1\cdot25}{44\cdot75}\times671\cdot25\times8=£150.=\textit{Ans.}$$

(72.) Here $t\,u-p\times2=\overline{60\times5\cdot5-291\cdot3512}\times2=77\cdot37$ and $2\,p\,t+t\,u-t\,t\,u=\overline{2\times291\cdot3125\times5\cdot5}+\overline{60\times5\cdot5}-\overline{60\times5\cdot5\times5\cdot5}=1719\cdot4375$.

$$\therefore\ r=\frac{77\cdot375}{1719\cdot4375}=\cdot045=4\tfrac{1}{2}\ \textit{per cent.}=\textit{Ans.}$$

(73.) Here $\overline{250\times7-1454\cdot225}\times2=591\cdot55$.
also, $\overline{2\times1454\cdot225\times7}+\overline{250\times7}-\overline{250\times7\times7}=9859\cdot1$

$$\therefore\ r=\frac{591\cdot55}{9859\cdot15}=\cdot06,\ \text{or } 6\ \textit{per cent.}=\textit{Ans.}$$

(74.) Here $\overline{28\times8-188}\times2=72$; and $\overline{2\times188\times8}+\overline{28\times8}-\overline{28\times8\times8}=1440$; $\therefore\ r=\frac{72}{1440}=\cdot05$. or 5 *per cent.*$=$*Ans.*

(75.) Here (*see Note after Ex.* 74) $\overline{75\times10-667\cdot5}\times2=165$. and $\overline{2\times667\cdot5\times10}+\overline{75\times10}-\overline{75\times10\times10}=6600$

$\therefore\ r=\frac{165}{6600}=\cdot025=$ the half-yearly ratio, or 5 *per cent.*$=$*Ans.*

(76.) Here $\overline{37\cdot5\times20-671\cdot25}\times2=157\cdot5$;and $\overline{2\times671\cdot25\times20}+\overline{37\cdot5\times20}-\overline{37\cdot5\times20\times20}=12600$.

$\therefore\ r=\frac{157\cdot5}{12600}=\cdot0125$, the quarterly ratio which answers to 5 *per cent.*

IV. When u, p, and r, are given to find t.

FORMULA IV. $\frac{2}{r}\quad\frac{2p}{u}-1=x$: then $\sqrt{\frac{2p}{ur}+\frac{x^2}{4}}-\frac{x}{2}=t$.

(78.) Here $\frac{2}{r}-\frac{2p}{u}-1=\frac{2}{\cdot045}-\frac{291\cdot3125\times2}{60}-1=33\cdot734$.

and $\frac{2p}{ur}=\frac{582\cdot625}{60\times\cdot045}=215\cdot787$. also; $\frac{x^2}{4}=284\cdot4957$.

∴ $t=\sqrt{(215\cdot787+284\cdot4957)}-\frac{33\cdot734}{2}=22\cdot367-16\cdot867=5\cdot5=5\frac{1}{2}$ *years=Ans.*

(79.) Here $\frac{2}{\cdot06}-\frac{1454\cdot225\times2}{250}-1=20\cdot6995+$

and $\frac{1425\times2}{250\times\cdot06}=193\cdot8966$; also $\frac{20\cdot6995^2}{4}=107\cdot1173$

∴ $r=\sqrt{193\cdot8966+107\cdot1173}-\frac{20\cdot6995}{2}=17\cdot3498-10\cdot3498=7$ *years.=Ans.*

(80.) Here $\frac{2}{\cdot05}-\frac{188\times2}{28}-1=25\frac{4}{7}$

and $\frac{188\times2}{28\times05}=268\cdot5714$; also $\frac{179}{7}\times\frac{179}{7}\times\frac{1}{4}=163\cdot9847$: $r=\sqrt{268\cdot5714+163\cdot9847}-12\cdot79=20\cdot79-12\cdot79=8$ *years.=Ans*

(81.) Here (*see the Note after Ex.* 80.)

$\frac{2}{\cdot025}-\frac{667\cdot5\times2}{75}-1=61\cdot2\cdot\frac{667\cdot5\times2}{75\times\cdot025}=712\cdot$

$\frac{61\cdot2\times61\cdot2}{4}=936\cdot36$

∴ $r=\sqrt{712+936\cdot36}-30\cdot6=40\cdot6-30\cdot6=10$ *half-yearly payments, or* 5 *years.=Ans.*

(82.) **Here** $\frac{2}{\cdot0125}-\frac{671\cdot25\times2}{37\cdot5}-1=123\cdot2$

and $\frac{671\cdot25\times2}{37\cdot5\times\cdot0125}=2864.$ **also** $\frac{x^2}{4}=3794\cdot56.$

$\therefore r=\sqrt{2864+3794\cdot56}-61\cdot6=81\cdot6-61\cdot6=20$ *quarterly payments, or* 5 *years.=Ans.*

ANNUITIES, &c., TAKEN IN REVERSION.

I. To find the present worth of an Annuity, &c., taken in Reversion.

(84.) Here, by FORMULA I. $\frac{ttr-tr+2t}{2tr+2}:\times u=$ $\frac{(4\times4\times\cdot04)-(4\times\cdot04)+(2\times4)}{(4\times\cdot04\times2)+2}\times50=182\cdot7586207=$ p. Then changing p into a by the 2nd Formula, we have $\frac{a}{tr+1}=\frac{182\cdot7586207}{(5\times\cdot04)+1}=152\cdot2988506=$£152 5*s*. 11*d*. 3 *qrs.=Ans.*

(85.) Here $\frac{(8\times8\times\cdot05)-(8\times\cdot05)+(2\times8)}{(8\times\cdot05\times2)+2}\times20=134\cdot2857142.$

$\therefore p=\frac{134\cdot2857142}{(4\times\cdot05)+1}=111\cdot904761=$£111 18*s*. 1·14*d*. *=Ans.*

PART IV.

DUODECIMALS.

OR, WHAT IS GENERALLY CALLED

CROSS-MULTIPLICATION, AND SQUARING OF DIMENSIONS BY ARTIFICERS AND WORKMEN.

(1.)

$$\begin{array}{rcrr} \textit{Ft.} & & \textit{in.} & \textit{sec.} \\ 9 & & 0 & \\ & \times & & \\ 3 & & 6 & \\ \hline 22 & & 0 & 0 \\ 2 & & 3 & 0 \\ 3 & & 6 & 0 \\ & & 4 & 6 \\ \hline 27 & & 1 & 6 = \textit{Ans.} \end{array}$$

(2.)

$$\begin{array}{rcrr} \textit{Ft.} & & \textit{in.} & \textit{sec.} \\ 8 & & 5 & \\ & \times & & \\ 4 & & 7 & \\ \hline 32 & & 0 & 0 \\ 1 & & 8 & 0 \\ 4 & & 8 & 0 \\ & & 2 & 11 \\ \hline 38 & & 6 & 11 = \textit{Ans.} \end{array}$$

(3.)

$$\begin{array}{rcr} \textit{Ft.} & & \textit{in.} \\ 9 & & 8 \\ & \times & \\ 7 & & 6 \\ \hline 63 & & 0 \\ 4 & & 8 \\ 4 & & 6 \\ & & 4 \\ \hline 72 & & 6 = \textit{Ans.} \end{array}$$

(4.)

$$\begin{array}{rcrr} \textit{Ft.} & & \textit{in.} & \textit{sec.} \\ 8 & & 1 & \\ & \times & & \\ 3 & & 5 & \\ \hline 24 & & 0 & 0 \\ & & 3 & 0 \\ 3 & & 4 & 0 \\ & & & 5 \\ \hline 27 & & 7 & 5 = \textit{Ans.} \end{array}$$

(5.)

$$\begin{array}{rcrr} \textit{Ft.} & & \textit{in.} & \textit{sec.} \\ 7 & & 6 & \\ & \times & & \\ 5 & & 9 & \\ \hline 35 & & 0 & 0 \\ 2 & & 6 & 0 \\ 5 & & 3 & 0 \\ & & 4 & 6 \\ \hline 43 & & 1 & 6 = \textit{Ans.} \end{array}$$

(6.)

$$\begin{array}{rcrr} \textit{Ft.} & & \textit{in.} & \textit{sec.} \\ 4 & & 7 & \\ & \times & & \\ 3 & & 10 & \\ \hline 12 & & 0 & 0 \\ 1 & & 9 & 0 \\ 3 & & 4 & 0 \\ & & 5 & 10 \\ \hline 17 & & 6 & 10 = \textit{Ans} \end{array}$$

	Ft.	*in.*	*sec.*	'''	''''	
(7.)	7	5	9			
	3	5	3			
	22	5	3			
	3	1	4	9		
		1	10	5	3	
	25	8	6	2	3	=*Ans.*

	Ft.	*in.*	*sec*	'''	''''
(8.)	10	4	5		
	7	8	6		
	72	6	11		
	6	10	11	4	
		5	2	2	6
	79	11	0	6	6

	Ft.	*in.*	*sec.*	
(9.)	75	7		
	9	8		
	680	3		
	50	4	8	
	730	7	8	=*Ans.*

	Ft.	*in*	
(10.)	97	8	
	8	9	
	781	4	
	73	3	
	854	7	=*Ans.*

	Ft.	*in.*	*sec.*	
(11.)	57	9		
	9	5		
	519	9		
	24	0	9	
	543	9	9	=*Ans.*

	Ft.	*in.*	*sec.*	
(12.)	75	9		
	17	7		
	1287	9		
	44	2	3	
	1331	11	3	=*Ans.*

	Ft.	*in.*	*sec.*	
(13.)	87	5		
	35	8		
	3059	7		
	58	3	4	
	3117	10	4	=*Ans.*

	Ft.	*in.*	*sec.*	
(14.)	179	3		
	38	10		
	6811	6		
	149	4	6	
	6960	10	6	=*Ans.*

	Ft.	*in.*	*sec.*	
(15.)	259	2		
	48	11		
	12440	0		
	237	6	10	
	12677	6	10	=*Ans.*

	Ft.	*in.*	*sec.*	
(16.)	257	9		
	39	11		
	10052	3		
	236	3	3	
	10288	6	3	=Ans.

	Ft.	*in.*	*sec.*	'''	'''
(17.)	311	4	7		
	36	7	5		
	11209	9	0		
	181	7	8	1	
	10	9	8	10	11
Ans.=	11402	2	4	11	11

	Ft.	*in.*	*sec.*	''	''''
(18.)	321	7	3		
	9	3	6		
	2894	5	3		
	80	4	9	9	
	13	4	9	7	6
Ans.=	2988	2	10	4	6

* * *

The Application.

1. *Measuring by the Foot Square, as Glaziers and Masons' Flat-Work.*

(19.) *First*	7	10		*the heights added.*
	6	8		
	5	4		
	19	10		*sum.*
		3		*windows.*
	59	6		*in a tier.*
	3	11		*in a breadth.*
	178	6		
	54	6	6	
	233	0	0	*whole superficies.*

	Sq ft.	*sq pts.*	*sq in.*	
Then	233	0	6	at 14*d.* *per foot.*
|2*d.*| $\frac{1}{6}$ |	233			= 1*s.*
	38	10		= 2*d.*
		0½		= 6 *sq. in.*
2,0)	27,1	10½		
	£13 11	10½		=*Ans.*

(20.) *First* 4 10 = *length.*
2 11 = *breadth.*
9 8
4 5 2
14 1 2 = *superficies of one squa*
8
112 9 4 = *eight squares.*

d. Sq ft. sq pts. sq in.
Then | 4 | ⅓ | 112 9 4 at 4½*d. per foot.*
37 4 = 4*d.*
4 8 = ½ *q.*
3¼ = 9 *sq. pts.* and 4 *sq. in.*
2,0)4,2 3¼
£2 2 3¼

Ft. in.
21.) *First* 1 6 = *width.*
3 = *height.*
4 6 = 1 *window.*
8
36 0 = *eight windows.*

hen 36 *sq. ft.* at 7¾*d. per sq. foot, comes to* 1*l.* 3*s.* 3*d.* = *A.*

Ft. in.
(22.) *First* 5 7 = *length.*
1 10 = *breadth.*
5 7
4 7 10
10 2 10 = *superficies of the slab, which at* 6*s.*
foot, comes to 3*l.* 1*s.* 5*d.* = *Ans.*

2. *Measuring by the Yard Square, as Paviers, Painters, Plasterers, and Joiners.*

	Ft.	*in*		
(23.)	74	9		=*length.*
	11	6		=*width.*
	822	3		
	37	4	6	
	859	7	6	=*superficies of the room.*

Then 859 *sq. ft.* 7 *sq pts.* 6 *sq. in. after the rate of* 3*s.* 10½*d. per sq. yard, comes to* 18*l.* 10*s.* 1¼*d.*+=*Ans.*

		Ft.	*in.*		
(24.)	*First*	58	6		=*length.*
		54	9		=*breadth.*
		3159	0		
		43	10	6	
		3202	10	6	=*area of the yard.*

Then 3202 *sq. ft.* 10 *sq. pts.* 6 *sq. in. after the rate of* 4¾*d. per sq. yard, comes to* 7*l.* 0*s.* 10¼*d.*+=*Ans.*

		Ft.	*in.*		
(25.)	*First*	97	8		=*compass.*
		9	10		=*height.*
		879	0		
		81	4	8	
		960	4	8	=*superficies.*

Then 960 *sq. ft.* 4 *sq. pts.* 8 *sq. in. after the rate of* 2*s.* 8¾*d. per sq. yard, comes to* 14*l.* 11*s.* 2½*d.*+=*Ans.*

		Ft.	*in.*		
(26.)	*First*	8	3		=*length.*
		6	6		=*breadth.*
		49	6		
		4	1	6	
		53	7	6	=5 *sq. yds,* 8 *sq. ft.* 7 *sq. pts.* 6 *sq. in. content.*

Then 5 *sq. yds.* 8 *sq. ft.* 7 sq. pts. 6 sq. *in. at* 6*s.* 7½*d. per sq. yard,* comes to 1l. 19s. 5½d.+=Ans.

Ft. *in.*
(27.) *First* 27 10=*length.*
14 9=*breadth.*
389 8
20 10 6
410 6 6=45 *sq. yds.* 5 *sq. ft.* 6 *sq. pts.*
6 *sq. in.area.*

Then 45 *sq. yds.* 5 *sq. ft.* 6 *sq. pts.* 6 *sq. in. at* 3*s.* 2*d. per sq. yard, comes to* 7*l.* 4*s.* 5¼*d.*+=*Ans.*

Ft. *in.*
(28.) *First* 68 6=*length.*
5 6=*breadth.*
342 6
34 3
Diff.=376 9=41·861′ *sq. yds.*=*area of the footway*

Then 41·861′ *sq. yds. at* 3*s.* 6*d. per sq. yd. comes to* 146·51*s.*

Ft. *in.*
Again 42 9=*front.*
68 6=*depth.*
2907 0
21 4 6
2928 4 6=*area of the court-yard*
376 9 0=*area of the foot-way.*
Diff.=2551 7 6=283·514 *sq. yds.*

Then 283:514 *sq. yds. at* 3*s. per sq. yd. comes to* 850·54*s.*; *whence* 850·54*s.*+146·51*s.*=997·05=49*l.* 17*s.* 0½*d.*+=*A.*

Ft. in.
29.) *First* 21 8=*length.*
14 10=*breadth.*
303 4
18 0 8
321 4 8=35·709 *sq. yds.*

Then 35·709 *sq. yds.* × 10*d.*=357·09*d.*=1l. 9s. 9d.+=Ans.

(30.) *First* 83 8=*height* } *of the room.*
12 6=*compass* }
1004 0
41 10
1045 10=116·2307 *sq. yds.; then* 116·2037 ×6*s.*=697·2222*s.*

Ft. in.
Again 7 8=*height* } *of the shutters.*
3 6=*breadth* }
23 0
3 10
26 10=*surface of one snutter.*
3
2)80 6=*surface of three shutters.*
40 3=*half-work*=4·472′ *sq. yards.*
Then 4·472′ ×6*s.*=26·83′*s.*

Ft. in.
Once more 3 6=*height* } *of the door.*
7 0=*breadth* }
2)24 6
12 3=*half-work*=1·36 *sq. yd. then* 1·36 × 6*s.*=8·16*s.*

Lastly 697·2222*s.* + 26·83′*s.* + 8·16*s.*=732·2155*s.*=36*l.* 12*s.* 2½*d.*+=*Ans.*

3. *Measuring by the Square of* 100 *feet, as Flooring, Partitioning, Roofing, Tiling, &c.*

Ft. in.
(31.) *Here* 173 10=*length* } *of the partitioning.*
10 7=*breadth* }
1738 4
101 4 10
1839 8 10=18 *sqrs.* 39 *sq. ft.* 8 *sq. pts.* 10 sq. in.=*Ans.*

Ft. *in.*
(32.) 20 8=*length* } *of the house.*
16 9=*breadth* }
330 8
15 6
346 2=*surface of the first floor.*
4
1384 8=*surface of the whole.*

Ft. *in.*
4 6=*breadth* } *of the first fire-place.*
6 0=*length* }
27 0=*its surface.*
2
54 0=*surface of the first two ditto.*

Ft. *in.*
5 4=*breadth* } *of the second fire-place.*
6 0=*length* }
32 0=*its surface.*
2
64 0=*surface of the second two ditto.*

Ft. *in.*
5 8=*length* } *of the third fire-place.*
4 8=*breadth* }
22 8
3 9 4
26 5 4=*its surface.*
2
52 10 8=*surface of the third twò ditto.*

Ft. *in*
5 2=*length* } *of the seventh fire-place.*
4 0=*breadth* }
20 8=*its surface.*

Ft. in. sec.
10 6=*length*
8 9=*breadth* } *of the well-hole.*
84 0
7 10 6
91 10 6=*area of it at the ground floor.*
4=*the quantity of area taken up by the well-hole.*
367 6 0

Ft. pts. in.
54 0 0
64 0 0
52 10 8 } *the different areas.*
20 8 0
367 6 0
559 0 8=*the sum of the areas of the fire-places, &c.*

Whence 1384 *sq. ft.* 8 *sq. pts.*—559 *sq. ft.* 0 *sq. pts.* 8 *sq. in.* =825*sq. ft.* 7 *sq. pts.* 4 *sq. in.*=8 *squares.* 25 *sq. ft.* 7 *sq. pts.* 4*sq. in. which at* 6*l.* 10*s. per square, comes to* 53*l.* 13*s.* 3½*d.*+ *the answer required.*

Ft. in.
(33.) *First* 52 8=*length*
30 6=*breadth* } *of the house.*
1580 0
26 4
1606 4=*area within the walls.*
803 2=*half ditto.*
Sum=2409 6=24·095 *squares; then* 24·095 × 10½*s.* =252·9975*s.*=12*l.* 12*s.* 11¾*d.*+*the answer required.*

Ft. in.
(34.) *First* 43 10=*length*
27 5=*breadth* } *of the barn.*
1183 6
18 3 2
1201 9 2=*the area.*
600 10 7=*half ditto.*
1802 7 9=*sum.*
116 10 8 *add.*
Sum=1919 6 5=19·195346′ *squares*

$$\begin{array}{lrrrl}
 & \textit{Ft.} & \textit{in.} & & \\
\textit{Secondly} & 43 & 10 & & =\textit{length} \\
 & 2 & 8 & & =\textit{breadth} \\
\hline
 & 87 & 8 & & \\
 & 29 & 2 & 8 & \\
\hline
 & 116 & 10 & 8 & =\textit{surface of eave boards}
\end{array}
\left.\right\} \textit{of eave boards.}$$

Then 10·195346′ × 25½*s.* = 489·48134*s.* = 24*l.* 9*s.* 5¾*d.*+ *the answer required.*

4. *Meaſuring by the Rod.*

(35.) *First* $\frac{4085\times5}{3}=6808\cdot3'$, then $\frac{6808\cdot3}{272\cdot25}=25$ *rods*+ = *A*

$$\begin{array}{lrr}
 & \textit{Ft.} & \textit{in.} \\
\text{(36.) }\textit{First} & 254 & 0 \\
 & 12 & 7 \\
\hline
 & 3048 & 0 \\
 & 148 & 2 \\
\hline
\textit{Sum}= & 3196 & 2
\end{array} = 3196\cdot16' \textit{ sq. ft.} = \textit{the area.}$$

Then $\frac{3196\cdot16'\times6}{3}=6392\cdot3'$, and $\frac{6392\cdot3'}{272\cdot25}=23$ *rods*, 130*ft.* 7 *pts.*+ = *Ans.*

$$\begin{array}{lrr}
 & \textit{Ft.} & \textit{in.} \\
\text{(37.) }\textit{First} & 62 & 6 \\
 & 14 & 8 \\
\hline
 & 875 & 0 \\
 & 41 & 8 \\
\hline
\textit{Sum}= & 916 & 8
\end{array} = 916\cdot6' \textit{ sq. ft.} = \textit{the area.}$$

Then $\frac{916\cdot6'\times5}{3}=1527\cdot7'$ and $\frac{1527\cdot7'}{272\cdot25}=5$ *rods*, 166 *ft.* 6 *pts.*+ *the answer required.*

$$\begin{array}{lrr}
 & \textit{Ft.} & \textit{in} \\
\text{(38.) }\textit{First} & 28 & 10 \\
 & 20 & 0 \\
\hline
\textit{Prod.}= & 576 & 8
\end{array} = 576\cdot6' \textit{ sq. ft.}$$

Then $\frac{576\cdot6'\times5}{3}=961\cdot1'$ = *area of the first height, at 2½ bricks thick.*

	Ft.	*in.*	
Secondly	28	10	
	20	0	
Prod.=	576	8	=576·6′ *sq. ft.*

Then $\frac{576\cdot6'\times4}{3}$=768·8′=*area of the second height, at* 2 *bricks thick.*

	Ft.	*in.*		
Thirdly	28	10		
	15	8		
	432	6		
	19	2	8	
Sum=	451	8	8	=451·72′ *sq. ft. area of the third height, at* 1½ *brick thick.*

	Ft.	*in.*	
Fourthly	28	10	
	10	6	=42 *courses*÷4.
	288	4	
	14	5	
Sum=	302	9	=302·75 *sq. ft.*

Then $\frac{302\cdot75}{3}$=100·916′ *sq. ft.*=*area of the gable end.*

Hence	961·111′	*area of the first height.*
	768·888′	*area of the second height.*
	451·722′	*area of the third height.*
	100·916′	*area of the gable end.*
	2282·638′	*sq. ft.*=*the sum of the areas, which divided by* 272·25, gives 8·384348 *rods*, and 8·384348 × 5·8*l.*=48·6292184*l.*=48*l.* 12*s.* 7*d.*+*the answer required.*

SOLUTIONS TO THE PROMISCUOUS QUESTIONS.

Part V.

(1.) Here 2502205=*the answer required.*

(2.) Here 254×14×4½*d.*=16002*d.*=66*l.* 13*s.* 6*d.*=

(3.) Here as $5l. : 100l. :: 20l. : \frac{20\times100}{5}$. *Again,*

Here as 12 *months* $: \frac{20\times100l.}{5} :: 8$ *months* $: \frac{20\times100\times12l}{5\times8}$ $=100\times6l.=600l.=$ *Ans.*

(4.) First $14^2=196$, and $12^2=144$, then $(250+196)-144=302=$ *Ans.*

(5.) Here $\left.\begin{matrix}320\times5\\460\times3\end{matrix}\right\}=\left\{\begin{matrix}1600 &: \text{A's}\\ \underline{1380} &: \text{B's}\end{matrix}\right\}$ Stock $\times$ed into his time.

$\overline{2980}=$Sum of products.

$$\text{As}\frac{2980l.}{20}=149l.: 100l.::$$

$$\left\{\begin{matrix}\frac{1600l.}{20}=80l.:53l.\ 13s.\ 9\frac{270}{298}=\text{A's}\\ \frac{1380l.}{20}=69l.:46l.\ \ 6s.\ \ 2\frac{228}{298}=\text{B's}\end{matrix}\right\}\text{gain.}$$

$$\text{Sum}=\overline{100l.\quad 0\quad 0}\ \text{proof.}$$

(6.) First 13 *cwt.* 2 *qrs.*$=1512$ *lb.*, then $1512\times14d.=21168d.$ the price of the wool: *again,* as $210d.$ $(=17s.\ 6d.)$ $: 1$ *yd.*$::21168d. : 100$ *yds.* $3\frac{1}{5}$ *qrs.*$=$*Ans.*

(7.) First $21^3=9261$, and $113\times147=16611$; then $16611-9261=7350.=$*Ans.*

(8.) First $90l. + 10l.=100l$; then as 1000×3 *qrs.* $: 100l. :: 5$ *qrs.* $: 3s.\ 4d.=$*Ans.*

(9.) First as $14s. : 16s. :: 42l. : 48l.$, the advanced price of the tun.$=$ 1*st Ans.*

Again, as $42l.=840s. : 1$ *tun* $:: 648\times14s.=9072s. : \frac{9072}{840}$*tuns*$=10$ *tuns,* 3 *hhds.* $12\frac{3}{5}$ *gals.*$=$2*nd Ans.*

(10.) First $876\times16\frac{1}{2}s. = 14454s. = 722l.\ 14s.$ then $1200l.-722l.\ 14s.=477l.\ 6s.=$*Ans.*

(11.) First 417 *cwt.* 1 *qr.* 15*lb.*$=$ 46747 *gross weight.*

From which deduct.... $\underline{8347}+$*tare.*

38400$=$*neat weight.*

Then $38400\times\frac{2}{15}=5120$ *gals.*$=$*Ans.*

(12.) Here $(4\times3\times20l.)-(3\times3\times20l.)=1\times3\times20l=60l.$ gained by the bargain$=\frac{1}{3}$ of the cost.

Hence $4\times3\times20l.+\frac{4\times3\times20l.}{3}=240l.+80l.=320l=A$

(13.) First $54^2=2916$, and $46\times19=874$, then $2916-874=2042$, the number required.

(14.) Here as 14*s.* 6*d.* = 174*d.* : 16*s.* 9*d.*—14*s.* 6*d.*= 2*s.* 3*d.*=27*d.*=gain on 14*s.* 6*d.* :: 100*l.* : $\frac{27\times100l.}{174}=15l.$ 10*s.* 4*d.*$\frac{24}{174}$=*Ans.*

(15.) First $84\cdot75lb.\times27=$ 2288·25*lb.* *the gross weight.*
and $1\cdot375\ \times27=$ 37·125 *the tare.*

$\frac{1}{26}$)2251·125 *suttle.*
86·5817 *tret.*

Diff.=2164·5433 *lb. neat*, which at 8½*d. per lb.* comes to 18398·618*d.*=76*l.* 13*s.* 2½*d.*=*Ans.*

(16.) Here $\frac{2}{3}oz.:\frac{7}{8}s.::\frac{5}{6}\text{of}\frac{16}{1}oz.:\frac{3}{2}\times\frac{7}{8}\times\frac{5}{6}\times\frac{16}{1}s.=\frac{7\times5}{2}s.=\frac{35}{2}s.=17s.\ 6d=Ans.$

(17.) Here $\frac{5}{6}gall.:\frac{5}{8}l.::\frac{5}{9}\text{of}\frac{252}{1}gall.:\frac{6}{5}\times\frac{5}{8}\times\frac{5}{9}\times\frac{252}{1}l.=\frac{5\times252l}{12}=5\times21l.=105l.=Ans.$

(18.) First $210l.\div\frac{2}{3}=315l$=the eldest brother's portion.

Hence $315l.\times3\times2=1890l.$=the father's estate.

(19.) Here as 365 *days* : 48*l.* :: 232 *days* : $\frac{232\times48}{365}$ =30*l.* 10*s.* 2¼*d.*=*Ans.*

(20.) Here, if 1*d.* : 1·39375*l.* :: 365*d.* : 508·71875*l.* then 508·71875*l.*+340*l.*=848·71875*l.* =848*l.* 14*s.* 4½*d*= *Ans.*

(21.) First $16\times2=32$, the number of partitions, then $37\cdot5l.\times32=1200l.$; hence $1200l.+200l.=1400l.$ the *lady's* portion.=*Ans.*

$$\begin{array}{lrl} & & \quad lb. \qquad lb. \\ (22.) & \text{First,} & 13\times19{\cdot}5\times112=28392 \\ & & \qquad\quad 39\times388=15132 \\ & & \text{Diff.}=\overline{13260}\ lb.=212160\ oz.= \end{array}$$

Ans.

(23.) First 1360*l.*÷5=272*l.*=*Captain's share*=1*st A.* and (1360*l.*—272*l.*)÷160=6*l.* 16*s.* *each Sailor's share*= 2*nd Ans.*

(24.) First $12\frac{1}{4}=12\frac{3}{12}$, and secondly $7\frac{2}{3}=7\frac{8}{12}$, whence $12\frac{3}{12}-7\frac{8}{12}=4\frac{7}{12}$. the number required.

(25.) First 81*l.*—75*l.*=6*l.* the interest of 75*l.* for 1 yr.; whence we have as 75*l*, : 6*l.* :: 100*l.* : 8 per cent.=*A.*

(26.) First 956*l.*×7·5×·05 = 358·5*l.* the interest for the given time; whence 956*l.*+358*l.* 10*s.*=1314*l.* 10*s.* the amount required.

(27.) Here by *Formula* IV. page 160 *Arith.* $r=\frac{a-p}{pt.}$, we have $\frac{1314{\cdot}5-956}{956\times7{\cdot}5}=\cdot05$, or 5*l.* the rate per cent.

(28.) Here if 36 *miles* : 1200*lb.* :: 24 *miles* : $\frac{1200lb.\times36}{24}$ =1800*lb.*=*Ans.*

(29.) Here if 8 *can.* : 48 *bar.* :: 24 *can.* : 144 *bar.* : *again*, as 1*d.* : 144 *bar.* :: 22*d.* : 3168 *bar.*=*Ans.*

(30.) Here any product being divided by its multiplier, will produce the multiplicand, as is well known, whence $\frac{1}{4}\div\frac{2}{3}=\frac{3}{8}$=*Ans.*

$$\begin{array}{llrrrll} & & \pounds & s. & & \pounds & s. \\ (31.) & \text{First} & 13 & 0\times & 7= & 91 & 0 \text{ value of B's horses.} \\ & \text{and} & 3 & 12\times & 24= & 86 & 8\ldots\ldots\ldots\text{A's kine.} \\ & & & & \text{Diff.}= & \overline{4} & \overline{12}=Ans. \end{array}$$

$$\begin{array}{llll} & & & \pounds \\ (32.) & \text{Here suppose} & \text{A's share} & 1 \\ & \quad\text{then} & \text{B's} \ldots\ldots & 2 \\ & \quad\text{and} & \text{C's} \ldots\ldots & 3 \\ & & & \overline{} \end{array}$$

$$\text{Whence as } 6 : \overset{\pounds}{120} :: \left\{\begin{array}{l} \overset{\pounds\ \ \pounds}{1:20}\ \text{A's} \\ 2:40\ \text{B's} \\ 3:60\ \text{C's} \end{array}\right\}\text{share.}$$

(33.) First $1250l.\times4=5000l.$; then $1780l.+5000l.=6780l.$=what he left to his widow and children; *again*, $126l.\times25\frac{1}{2}=3213l.$ the sum cleared the time he was in trade; whence $6780l.—3213l.=3567l.$ what he had to begin trade with.=*Ans.*

$$\text{(34.) Here as }\overset{£}{16}\,(=3+5+8):\overset{£}{1000}::\left\{\begin{array}{rrr} £ & £ & s. \\ 3: & 187 & 10\ \text{A's} \\ 5: & 312 & 10\ \text{B's} \\ 8: & 500 & 0\ \text{C's} \end{array}\right\}\text{share.}$$

(35.) Here $1\times2\times3\times4\times5\times6=720$, the number of changes required.

(36.) Here as $2s.$: 1 *guild.* :: $642\times20s.$; $\frac{642\times20}{2}$ *guild.*=6420 *guild.*=*Ans.*

(37.) Here as 1 *mo.* : 360 *m.* :: 5 *mo.* : 72, the number of men, the remaining 1 month's provisions will serve 5 months, whence $360—72=288$ the number of men that must depart.=*Ans.*

(38.) First $187+34=221$, the greater number; then $187\times221=41327$. the product; whence $41327^2=1707920929$, the square of the product.=*Ans.*

(39.) First $216l.=4320s.$ the dividend;

$$\begin{array}{lrrl} & £ & s. & \\ \text{then} & 11 & 0= & 220 \\ & & & 40 \\ & 1 & 5= & 25 \\ & 1 & 15= & 35 \end{array}\left\}\text{price of}\left\{\begin{array}{l}\text{an ox.}\\ \text{a cow.}\\ \text{a colt.}\\ \text{a hog.}\end{array}\right.\right.$$

$$\text{Sum}=\overline{\underline{320}}\text{ the divisor;}$$

whence $4320\div320=13$ of each sort, and $8l.$ over.=*Ans.*

(40.) First $11\frac{5}{7}=11\frac{440}{616}$; then $36\frac{337}{616}—11\frac{440}{616}=24\frac{513}{616}$, =*Ans.*

(41.) First $11\frac{9}{17}=\frac{196}{17}$; then $\frac{196}{17}\div\frac{3}{7}=\frac{1372}{51}=26\frac{46}{51}$,=A

(42.) Here by *Formula* II. page 118 *Arith*, $d.=\frac{l—f}{n—1}$, we have (58 *years*—3 *years*)$\div(12—1)=5$ *years*, the common difference required.

(43.) Here $7179\times13\times41s.=3826407s.=191320l.\ 7s.$ =*Ans.*

(44.) Here $(500l.\ 13s.\ 6d.\times3\frac{1}{2})\div100=17l.\ 10s.\ 5\frac{1}{2}d.\ \frac{68}{100}q.$ =*Ans.*

(45.) First 15000*l.*—13200*l.* = 1800*l.* what Charlotte had left by the old lady, and 20000*l.*—13200*l.*=6800*l.* what Kitty had left by the same lady; whence 6800*l.*+1800*l.*= 3600*l.* the whole sum the old lady left them.=*Ans.*

(46.) Here on the day the Snail reached the top of the Maypole it advanced 8 feet, but on each of the other it only advanced 4 feet. Hence $\frac{20-8}{4}+1=\frac{12}{4}+1=3+1=4=$ number of days.=*Ans.*

(47.) Here if $\frac{6}{3}=\frac{6}{3}+\frac{1}{2}$ of $\frac{6}{3}$, similarly $\frac{20}{4}=\frac{20}{4}+\frac{1}{2}$ of $\frac{20}{4}$: that is, if 2=3, then 5=7½.=*Ans.*

(48.) Here the one-fourth of 14676 is 3669; whence 14676—3669=11007=*Ans.*

(49.) First 461*l.*+581*l.*=1042*l.*; then 1468*l.*—1042*l.* =426*l*=*Ans.*

(50.) First 3 *qrs.* 14 *lb.* = 98 *lb.* then 98÷112=·875 *cwt.*. the decimal required.

(51.) First 60×104*d.*=6240*d.* the value of the inkle; then 6240÷4½=1386⅔ pounds of sugar.=*Ans.*

(52.) Here 9*d.* : 4½*d.* :: 100*l.* : $\frac{9\times100}{9\times2}=\frac{100}{2}=50$*l.* the loss is ½ or 50 per cent.

(53.) Here
$$\begin{array}{rcr} 20\times 9 &=& 180\\ 60\times 12 &=& 720\\ 40\times 18 &=& 720\\ 12\times 24 &=& \underline{288}\\ \overline{132}=\left\{\begin{array}{r}12)\\ 11)\end{array}\right. & & \begin{array}{r}\overline{1908}\\ \overline{159}\end{array}\\ & & \underline{\underline{14\tfrac{1}{4}d.\tfrac{9}{11}}}=1s.\ 2\tfrac{1}{4}d.\tfrac{9}{11}.=\textit{Ans.}\end{array}$$

(54.) This question is the same as the 2*nd*, which see.

(55.) Here 2173*l.*+371*l.*=2544*l.*=B's debt required.

(56.) First 28×2=56, twice twenty-eight; and (8×2) +20=36, twice eight and twenty; then 56—36=20, their difference=1*st.* *Ans.* Again, 55×2=110, twice fifty-five; and 5×2+50=60, twice five and fifty; then 110—60= 50, the second difference.=2*nd* *Ans.*

(57.) First $54^2=2916$, and $46\times19=874$; then $2916-874=2042$, the number required.

(58.) Here suppose he had 4 scholars.
Then as many 4
Half as many 2
And $\frac{1}{4}$ as many 1
—

$$\text{As sum}=11:99::4:\frac{99\times4}{11}=9\times4$$

$=36$ scholars, the number he had.=*Ans.*

Or, putting x for the number of scholars, we have $2x+\frac{x}{2}+\frac{x}{4}=99$,

$$\text{or, } 22x=792.\therefore x=\frac{792}{22}=36=\textit{Ans.}$$

(59.) Here in this question we have given the first term, the common difference, and the number of terms of an *Arithmetical Progression*, to find the last term, thus:—*By Formula* VI. *(page* 120 *Arithmetic)* $l=f+[(n-1)d]=1+[(9-1)\times3]=1+(8\times3)=25$, which are the number of years more by 1 than the lady was in having her children; whence $24+19+19=62$ years, the lady's age.=*Ans.*

(60.) Here $706-168=538$. the number required.

(61.) Here 100*l.*—70*l.*=30*l.* the sum that's due to the maid.=*Ans.*

(60.) Here as 4*s.* : 18 *lb.* : : 6*s.* : $\frac{4\times18}{6}=12$ *lb.*=*Ans.*

(63.) Here a noble and a mark are=13*s.* 4*d.*+6*s.* 8*d.*=20*s.*; then, as 20*s.* : 15 *yds.* : : 1000*s.*=(50*l.*) : 750 *yds.* and $\frac{750\times4}{5}=600$ English ells.=*Ans.*

(64.) Here 650*l.* $\times400\div100=$ 2600*l.* and 130*l.* $\times400\div100=$ 520*l.*; then 2600*l.*—520*l.*=2080*l.* the whole loss=*Ans.*

(65.) First $4429\div43=103$, and then $240-103=137$, the number required.

(66.) First $2262 \div 26 = 87$, and then $2262 \div 87$, must be 26, whence $87 - 26 = 61$, the number required.

(67.) Here $(17+8+46)+(20\times2)=111$ years, the father's age at the time of his death.=*Ans.*

(68.) First as 6*s* : 6·5*s.* : : 9*d.* : 9$\frac{3}{4}$*d.* the advanced price of the cotton=1*st* *Ans.* Again, as 1 *doz.* : 6·5*s.* : : 100 *doz.* : 650*s.* the advanced value of the candles in barter; and lastly, as 9·75*d.* : 1 *lb.* : : 7800*d.*=(650*s.*) : 800*lb.*=7 *cwt.* 0 *qr.* 16 *lb.* the quantity of cotton that must be given for the hundred dozen of candles in barter.=2*nd. Ans.*

(69.) First $360-114=246$, the greater number; then $246-114=132$, their difference=1*st* *Ans.*, and $246\times114=28044$, their product—2*nd* *Ans.* Now the greater number divided by the less will be $246 \div 114 = 2\frac{3}{19}$, the quotient =3*rd* *Ans.*

(70.) Here as the brigade consists of 384 men, and there are to be 32 men in front, therefore $384 \div 32 = 12$, the number of ranks.=*Ans.*

(71.) First 73*l.* is=1460*s.* then 1460*s* $\div$365=4*s.*=*A.*

(72.) Here as 53*l.* : 70*d.* : : 100*l.* : $\frac{70\times100}{53}=132\frac{4}{53}$*d.* =11*s.* 0$\frac{4}{53}$*d.* what C ought to pay.=*Ans.*

(73.) First $100\div3=33\frac{1}{3}$*s.* Hence 33$\frac{1}{3}$*s* =cost of the first 100 *yds.*

Again, $100\div2=50$*s.* Hence 50*s.*=cost of the other 100 *yds.* Then 33$\frac{1}{3}$*s.*+50*s.*=83$\frac{1}{3}$*s.*=cost of the whole 200 *yds*,

Again, 5*yds.* : 2*s.* : : 200*yds.* : 80*s*; therefore 83$\frac{1}{3}$*s.*—80*s* =3$\frac{1}{3}$*s.*=3*s.* 4*d.* *loss.*=*Ans.*

(74.) Here $\frac{5}{8}$ of 20*s.*=$20\times5\div8$=12*s.* 6*d.*=*Ans.*

(75.) Here $\frac{3}{5}$ added to $\frac{1}{8}=\frac{24}{40}+\frac{5}{40}=\frac{29}{40}$ the number required.

(76.) Here as the money is worth 7 times the purse, the money *and* purse are together worth 8 times the purse; therefore 12*s.* 8*d.* $\div$ 8=1*s.* 7*d.* = value of the purse; and 12*s.* 8*d.*—1*s.* 7*d.* or 1*s.* 7*d.* $\times$ 7=11*s.* 1*d.*=the sum of money in the purse.

77.) Here the number=$9\div\frac{2}{3}=13\frac{1}{2}$=*Ans.*

(78.) First 4*s*. 6*d*.+4*s*.+3*s*. 6*d*.=12*s*. then 12÷3=4*s*. the value of the mixture.=*Ans*.

(79.) Here $30\left|\begin{array}{l|l|l} 48 & 6 & 6 \\ 36 & 6 & 6 \\ 24 & 18+6 & 24 \end{array}\right\}$ the quantities of each sort respectively. =*A*.

(80.) The value is 3740*l*.$\div\frac{3}{8}$=9973*l*. 6*s*. 8*d*.=*Ans*.

(81.) Here as the first child was born when the father was 24 years old, therefore 19×1½=28½, the time between the birth of the oldest and youngest, whence 24+28½+21 =73½, the father's age.=*Ans*.

(82.) Here as 5⅓*s*. : 1 *gal*. :: 1248*s*. = (62*l*. 8*s*.) : $\frac{1248\times3}{16}$=234 gallons.=*Ans*.

(83.) Here as 1*l*. : 7·5*s*. :: 296·85*l*. : 296·85×7·5= 2226·375=111*l*. 6*s*. 4½*d*. the sum C receives for his debt. =*Ans*.

(84.) First 190*l*. 12*s*.=11436 *groats;* then we have as 11 *groats* : 1 *pair* :: 11436 *groats* : 1039$\frac{7}{11}$ *pair*=86 *doz*. 7$\frac{7}{11}$ *pair*=*Ans*.

(85.) Here suppose there were 27 sheep in the fold at first, then the half thereof, plus half a sheep, is=13½ + ½ =14, whence 27—14=13, the number left after the first theft; proceeding in the same manner through the other two nights, there will be left but 2½ at the last, therefore 20—2½=17½, the first error in defect. Again, suppose there were 47 in the fold at first, then the half thereof, plus half a sheep, is=23½+½=24; whence 47—24=23, the number left after the first theft; proceeding as before, there will be left but 5 at the last, therefore 20—5=15, the second error in defect; here the errors are of a like kind. whence by the Rule of Double Position $\frac{(17\cdot5\times47)-(15\times27)}{17\cdot5-15}$ $=\frac{417\cdot5}{2\cdot5}$=167, the number of sheep at the first.=*Ans*.

Or thus Algebraically.

Let x = No. at first, then we obtain by the conditions *of the question.*

$$x-\frac{x}{2}-\frac{x}{4}-\frac{x}{8}-\frac{7}{8}=20$$

or, $64\,x-56\,x-56=1280 \therefore 8\,x=1336$, and $x=\frac{1336}{8}$ $=167=$*Ans.*

(86.) Here in 1 ton or 20 cwt. therefore 20 × 3 = 60 cwt. the weight of the whole club, and 60 cwt. ÷ 15 = 4 cwt. the weight of each. = *Ans.*

(87.) First 880 guineas $\div\frac{3}{20}=5866\frac{2}{3}$ guineas $=6160l.=$ sum of money *after* the commission was bought. Hence $6160l.+2200l.=8360l.=$sum of money before the commission was bought, which by the question is=fortune$-\frac{1}{5}$ fortune spent$=\frac{4}{5}$ fortune. Hence the fortune is $8360l.\div\frac{4}{5}=10450l.=$*Ans.*

(88.) First 395*l.* 18*s.* = 7918*s.* and 100*l.* 12*s* = 2012*s.*;

then as $7918s.:2012::20s.:\frac{2012\times20}{7918}=5s.\ 0\frac{3}{4}d.\frac{7446}{7918}=$*A.*

(89.) Here 360 guild. × 26 ÷ 52 = 180 dollars. = *Ans.*

(90.) Here $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$, being reduced to a common denominator, by *Case* I. *page* 125, and then added together, make $\frac{3}{4}$. Now let $\frac{4}{4}=1$, represent the whole sum of money at first, from which take $\frac{3}{4}$, and there remains $\frac{1}{4}$ part$=28l.$; therefore say as 1 : 4 :: 28*l.* : 112*l.* = *Ans.*

(91.) Here by Simple Interest, *Formula* II. *page* 159 *Arithmetic*, $a=p\,r\,t+p=(1000l\times{\cdot}0475\times5{\cdot}5\ yr.)+1000l.$ $=1261{\cdot}25=1261l.\ 5s.=$*Ans.*

(92.) Here the amount of 100*l.* at the given rate per cent. for the time of the first payment (*viz.* 4 months) is $\frac{305}{3}$ then by the rule in discount, $\frac{305}{3}l.:100l::350l.:\frac{105000}{305}l.$ the present worth of the first payment. *Again*, for the second time of payment, (*viz.* 8 months,) the amount of 100*l.* will be $\frac{310}{3}l.$, then $\frac{310}{3}l.:100l.::350l.:\frac{105000}{310}l.$ present worth of the second payment; hence $\frac{105000}{305}l.+\frac{105000}{310}l.=$ $\frac{64575000}{94550}l.=682l.\ 19s.\ 5\frac{1}{4}d.+=$*Ans.*

(93.) Here if 30*ft. long* : 18*ft. wide* $::\frac{9}{4}:30\times18\div\frac{9}{4}=240$ *feet* = 80*yds.* = *Ans.*

(94.) First $48\times2=96$ the greater number.
Then $96+48=144$ their sum.
And $96-48=\underline{48}$ their difference.
Hence $\underline{\underline{96}}$ is the second difference.$=$*Ans.*

(95.) First $\frac{19312l.\times5}{5}=32186l.\ 13s.\ 4d.=2$ year's rent; then $\frac{32186l.\ 13s.\ 4d.}{2}=16093l.\ 6s.\ 8d.$ the yearly income required.

(96.) First $25^2=625$ greater number, then $\sqrt{(625^2+25^2)}=625{\cdot}4998+=$*Ans.*

(97.) Here suppose B's sheep 10, and C's 18,

$$\begin{array}{rl} \text{Then if we add} \ldots\ldots\ldots & 4 \\ \hline \text{The sum}= & 14=\text{C's.} \end{array}$$

But $18+4$ is not$=6\times2=12$: here the error is 10.

Again, suppose B's sheep 16, and C's 24,

$$\begin{array}{rl} \text{Then if we add} \ldots\ldots\ldots & 4 \\ \hline \text{The sum}= & 20=\text{C's.} \end{array}$$

But $24+4$ is not $12\times2=24$: here the error is 4.
Here the errors are unlike; whence by the rule of Double Position $\frac{(16\times10)-(4\times10)}{10-4}=\frac{120}{6}=20$ sheep, the number B had.$=$1*st Ans.*
Hence C's number was $28=$2*nd Ans.*

Or thus,

Let $x=$No. B had. Then C would have $x+8$, receiving 4 from B, C would have $x+12$; and B, $x-4$. Then per *Q*, $x+12=2x-8$ $\therefore$ $x=20=$B's number.$=$1*st Ans.*
and $20+8=28$ C's$=$2*nd Ans.*

(98.) First $300l.+160l.+140l.=600l.$ then

$$\begin{array}{l} \text{As } 600l.\ :\ 120l. \\ \text{or, as } 5l.\ :\ 1l. \end{array} :: \left\{\begin{array}{l} 140l.\ :\ 28l.\ \text{B's} \\ 300l.\ :\ 60..\ \text{C's} \\ 160l.\ :\ 32l.\ \text{D's} \end{array}\right\} \text{gain.}=\textit{Ans.}$$

(99.) As the number of each are equal, therefore will $\frac{50\times12}{6+8+16}=\frac{60}{3}=20$ of each.$=$*Ans.*

(100.) First $19^3=6859$, and $17^2+48^2=2593$; then $6859-2593=4266$, the difference required.

	ft.	in.		
(101.)	4	6		=length.
	2	9		=breadth.
	9	0		
	3	4	6	
	12	4	6	=superficies, which
×ed by	3	4	0	=the depth.
	37	1	6	
	4	1	6	
Gives	41	3	0	the solidity required.

(102.) First $640\times22\frac{1}{2}=14400$*s.* their pay per month; then 14400*s.* $\times32=460800$*s.*$=23040$*l.*$=$*Ans,*

(103.) First 470*l.*-130*l.*$=340$*l.*; then as 365*d.* : 340*l.* :: 1*d.* : 18*s.* $7\frac{1}{2}$*d.* $\frac{90}{365}$*q.*$=$*Ans.*

(104.) Here any quotient multiplied by its divisor, will give the dividend, therefore $72\times19=1368$, the number required.

(105.) Here $13\frac{1}{2}\div36=\dfrac{13\times2+1}{2\times36}=\frac{27}{72}=\frac{3}{8}$, the fraction of a chaldron required.

(106.) First 28 *qrs.* 2 *bush.*=226 *bush.* then $226\times4\frac{1}{2}$*s.* $=1017$*s.*$=50$*l.* 17*s.*$=$*Ans.*

(107.) First 5*s.* 9*d.*=69*d.* and 13*s.* 4*d.*=160*d.*; then 426*lb.* × 160*d.*=68160*d.* the value of the tea; *again,* as 69*d.* : 1*lb.* :: 68160*d.* : $987\frac{57}{69}$*lb.* the coffee that is to be given in barter for the said tea.=*Ans.*

(108.) Here 27*doz.* 10*lb.* of candles=334*lb.* which at 5*d.* *per lb.* comes to 1670*d.*=6*l.* 19*s.* 2*d.*=*Ans.*

(109.) Here the value of 500 French crowns, at $4\frac{1}{2}$*s.* per crown=2250*s.*; again, a halfpenny per crown, or 500 halfpence=20*s.* 10*d.* whence 2250*s.*—20*s.* 10*d.*=2229*s.* 2*d.*= 111*l.* 9*s.* 2*d.* the sterling money *he ought* to receive.=*Ans.*

(110.) First $63^2\times31{\cdot}5^2=3938240{\cdot}25$, the product of their squares=1*st Ans.* *Again,* $(63\times31{\cdot}5)-(63+31{\cdot}5)=1890$, the difference of their product and sum.=2nd Ans.

(111.) First 7 *m.* + 11 *m.* = 18 *m.* the distance they travel per day; then as 1*d.* : 18 *m.* : : 12*d.* : 216 miles = *An.*

(112.) First 672 Sp. guild. × 2*s.* = 1344*s.* the value of the Spanish guilders, then as 17·5*s.* : 1 *F. pistole* : : 1344*s.* : 76$\frac{28}{35}$ *F. pistoles.* = *Ans.*

(113.) Here suppose the man was 12 years of age, then must the woman have been 36; and by the second conditions of the question, we have as 1 : 2 : : 22½ : 45, which should have been 46½, therefore the error is 1½. *Again*, suppose the man was ten years of age, then must the woman have been 30; and by the second conditions of the question, we have as 1 : 2 : : 20½ : 41. which should have been 40½, therefore the error is ½; here the errors are unlike, whence by the rule of Double Position $\frac{(1\frac{1}{2}\times10)+(\frac{1}{2}\times12)}{1\frac{1}{2}+\frac{1}{2}}=\frac{21}{2}=10\frac{1}{2}$ years, the man's age, = 1*st Ans.*

Hence the woman's age is 31½ years. = 2*nd Ans.*

Or thus Algebraically.

Let x and $3x$ represent their respective ages.

Then $x+10\frac{1}{2} : 3x+10\frac{1}{2} :: 8 : 16$, per question.

Whence $24x+84=16x+168$; and $8x=84$. $\therefore x=\frac{84}{8}=10\frac{1}{2}$ years, the man's age; and $3x=31\frac{1}{2}$, the woman's age.

(114,) $\left.\begin{array}{r}12 \text{ oxen} : 21 \text{ oxen}\\ 4 \text{ days} : 9 \text{ days}\end{array}\right\} :: 3\frac{1}{3}$ *acres.*

$\frac{21\times9\times3\frac{1}{3}}{12\times4}=\frac{210}{16}=\frac{105}{8}=13\frac{1}{8}$ acres, the quantity that will serve 21 oxen 9 weeks, *without growth.* But, by hypothesis, 10 acres will suffice, admitting its *growth* during the last 5 weeks; therefore the increase on 10 acres in 5 weeks = $3\frac{1}{8}$ acres.

Again, the *time* of increase on the 24 acres is (18—4=) 14 weeks; therefore,

$\left.\begin{array}{r}10 \text{ acres} : 24 \text{ acres}\\ 5 \text{ weeks} : 14 \text{ weeks}\end{array}\right\} :: 3\frac{1}{8}$ *acres.*

$\frac{24 \times 14 \times 3\frac{1}{8}}{10 \times 5}=21$ acres, the increase on the 24 acres in 14 weeks: consequently the whole produce of food for the required number of oxen, 18 weeks, is $24+21=45$ acres.

Lastly, as $\left.\begin{matrix} 18 \textit{ weeks} : 4 \textit{ weeks} \\ 3\frac{1}{3} \textit{ acres} : 45 \textit{ acres} \end{matrix}\right\} :: 12$ *oxen.*

$\frac{4 \times 45 \times 12}{18 \times 3\frac{1}{3}}=\frac{120}{3\frac{1}{3}}=36$ *oxen.*$=$*Ans.*

(115.) Let $x =$ he lady's age. Then $x \times 3=3x$

$\frac{2}{7}$ of $3x=\frac{6x}{7}$, which tripled$=\frac{18x}{7}$, and $\frac{2}{9}$ of $\frac{18x}{7}=\frac{36x}{63}=\frac{4x}{7}$

therefore per *Q.* $\frac{4x}{7}=16$, and $x=\frac{16 \times 7}{4}=28$, the lady's age required.

Or thus by the rule of Double Position.

Suppose the lady's age 14, then by the conditions of the question $14 \times 3 \times \frac{2}{7} \times 3 \times \frac{2}{9}=8$, but should have been equal to 16, therefore the error is 8 in defect.

Again, suppose the lady's age 21, then by the conditions of the question $21 \times 3 \times \frac{2}{7} \times 3 \times \frac{2}{9}=12$, but should have been equal to 16, therefore the error is 4 in defect, whence $\frac{(8 \times 21)-(4 \times 14)}{8-4}=\frac{112}{4}=28$, the lady's age as before.

(116.) Here the number required in this question is evidently equal to $48+72+19+7+12=158$.$=$*Ans.*

THE END.

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